Vol. 25 OCTOBER, 1904 No. 146

THE FOUNDRY

PUBLISHED MONTHLY BY
THE PENTON PUBLISHING CO.
CLEVELAND, OHIO.

Our Winners Your Winners

Established
1874

No. 702
Pure Ceylon Plumbago

"RELIANCE" CORE WASH
"OBERMAYER" SEA COAL FACING
"ESSO" INGOT MOULD BLACKING
"PINE" PARTING CHARCOAL

Send for a Trial Barrel of Each

If they don't assist you to produce better,
smoother, cleaner castings, return
at our expense. Charge
us up with freight,
drayage, etc.

The S. Obermayer Co.

CINCINNATI, O. CHICAGO, ILL. PITTSBURG, PA.

ORDER FROM NEAREST FACTORY

Manufacturers

"EVERYTHING YOU NEED IN YOUR FOUNDRY"

A Dependable Iron

that's unequalled for making good castings. The kind that please the maker and user. No chance for hard feelings between the other fellow's machine shop and your foundry.
When you use

Cherry Valley Iron

you hold all your customers and make the other foundries hustle to hold theirs. Quality counts in iron and good iron is the kind to make money with year in and year out.

Once Tried Always Used

Always the Same

Always the Best

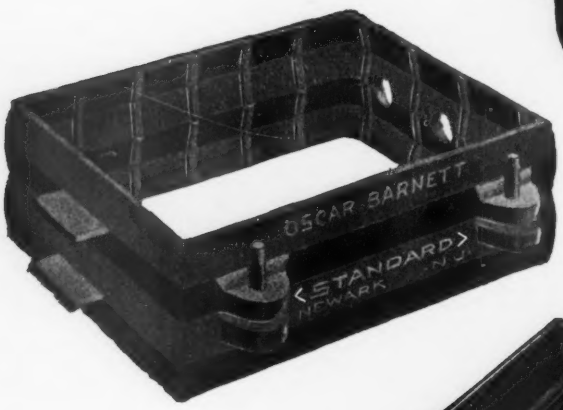
The Cherry Valley Iron Co.

PITTSBURG, PA.

BRASS MOLDERS' FLASKS

OF EVERY STYLE AND SIZE

Furnaces, Drying Stoves, Spill Troughs, Clamps, Boards, Tongs, Crucibles, etc., etc.



All our flasks interchange with any of same size made by us.

Our own foundries ensure prompt shipments

THE OSCAR BARNETT <STANDARD> FLASK

IS MADE ONLY BY

Oscar Barnett Foundry Co.

Founded 1845 **NEWARK, N. J., U.S.A.**

PIONEER PIG IRON

Is of the highest grade and always uniform. The ores and fuel used in its manufacture are entirely under the control of the Company and produced from their own mines adjacent to furnaces. If you use Pioneer Iron once, you will always desire to have it in your mixture. No trouble with your castings afterwards. It costs no more and is better than other standard grades. Let us have your inquiries.

For prices write,

THE REPUBLIC IRON AND STEEL CO.,

CHICAGO, ILL., BIRMINGHAM, ALA.

Or the following Sales Offices:

CLEVELAND, OHIO, ST. LOUIS, MO., ST. PAUL, MINN., BUFFALO, N. Y., CINCINNATI, OHIO, PITTSBURG, PA.

COM-PRESSORS PNEUMATIC TOOLS ROCK DRILLS

CUT
OUT

this ad. and fill in your name and we will send you printed matter from time to time as soon as it comes off the press.

You may find it handy once in a while. Invest 2 cents and try it.

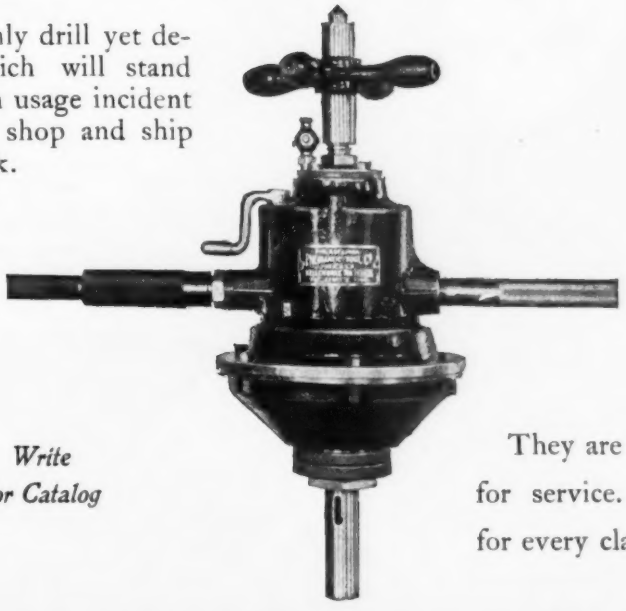
RAND DRILL CO. 128 BROADWAY N.Y.

For
Strength
Reliability
and
Speed

Fully
Guaranteed
in
every
particular

Keller Rotary Drills

The only drill yet devised which will stand the rough usage incident to boiler shop and ship yard work.



Write for Catalog

They are always ready for service. All sizes for every class of work.

Philadelphia Pneumatic Tool Co.

21ST AND ALLEGHENY AVE., PHILADELPHIA

New York Pittsburg Chicago San Francisco

William Sellers & Co., Incorp.

PHILADELPHIA, PA.

MODERN FOUNDRY MACHINERY

SAND MIXER

Not an Experiment

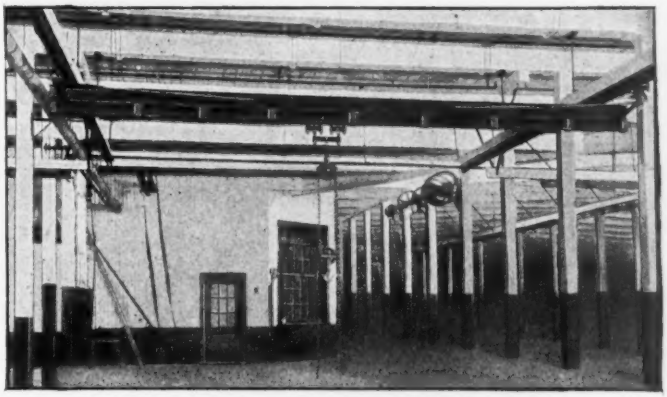
PRACTICAL
ECONOMICAL
EXPEDITIOUS

NOTE. — In order to clearly explain the **Modus Operandi** of this scientific and practical method of **mixing Molding Sand, Facing Sand** and **Core Sand,** we have issued a small pamphlet which will be sent on application.

TRAVELING CRANES FOR FOUNDRY USE.

Correspondence Is Solicited.

Coburn Trolley Tracks



are used in up-to-date foundries everywhere

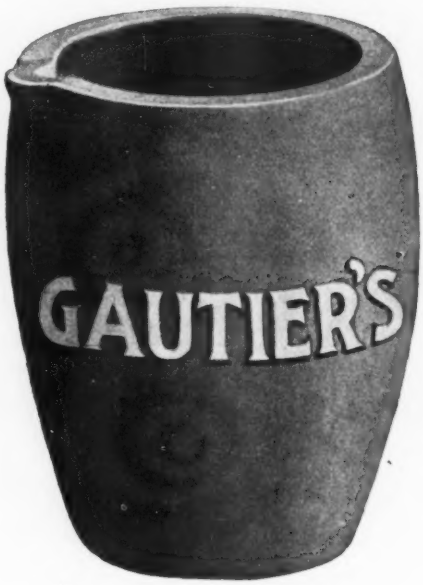
They enable one man to move as much foundry material as six men could move by hand. The saving in laborers' wages alone will soon pay for their installation. Flasks, sand castings or iron taken to any floor without fuss about gangways. The only apparatus for handling materials that's in nobody's way.

Think how this would increase the output of your plant, then tell us how your plant is laid out — we'll tell you how Coburn Trolley Tracks will save you money.

Coburn Trolley Track Mfg. Co.

HOLYOKE, MASS.

The Crucible of Quality
Therefore
The Crucible of Satisfaction



Proven so by nearly
fifty years of
satisfactory
service

J. H. Gautier & Co.

JERSEY CITY, N. J.

This trade mark stands for the acme of crucible uniformity.

There's no guess work in the manufacture of a Taylor Crucible. Only the highest grades of material are used, and working strictly by our chemical analysis, we give a uniformity in the quality the year round, that is not approached.

A trial will convince you.

Robert J. Taylor, Incorporated

1900 to 1916 Callowhill Street

PHILADELPHIA, PA.

77 Years
of
SUPREMACY

DIXON'S

We invite the inquiries of those who require Plumbago Crucibles for the usual or special melting purposes.

Joseph Dixon Crucible Co.

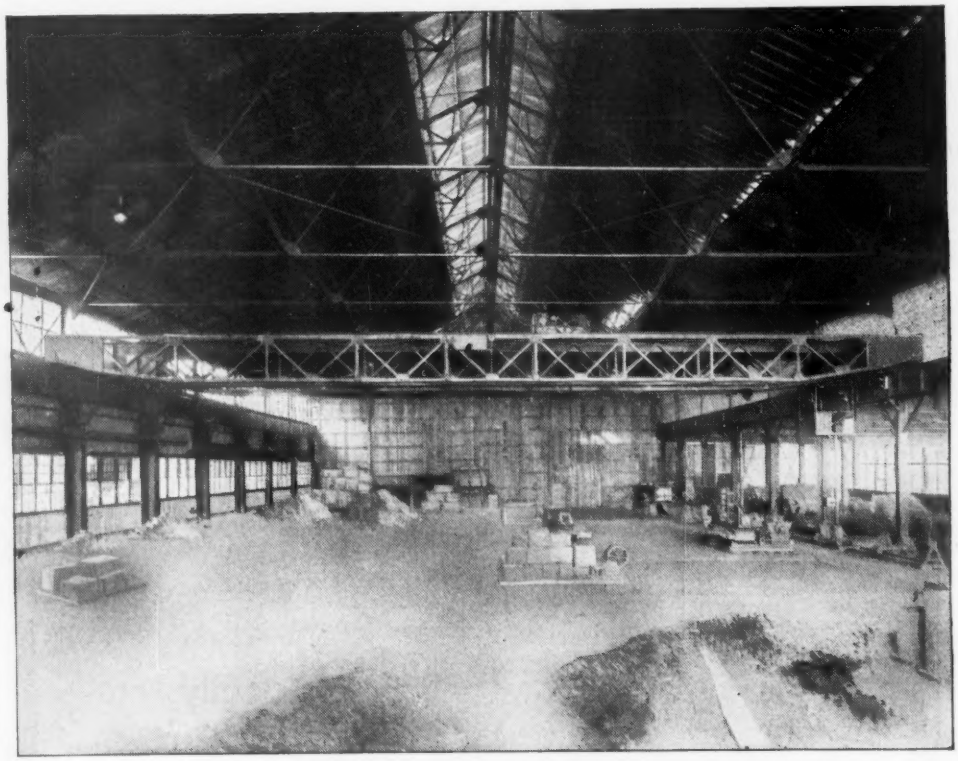
JERSEY CITY, N. J., U.S.A.

McCULLOUGH-DALZELL
No.
00 TO 300
CRUCIBLE CO
PITTSBURG PA.

Phosphor Bronze

can be made with less energy than formerly — since the advent of McCullough-Dalzell special phosphorizers.
Practical foundrymen know this.
Full particulars will be cheerfully furnished interested parties.

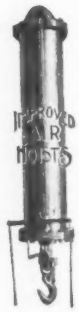
McCullough-Dalzell
Crucible Co.
Pittsburg
Pa.



Three-motor Electric Traveler, 10-tons capacity, 98-ft. span. Furnished McCormick Division, International Harvester Co., Chicago.

ELECTRIC TRAVELERS

CRANES OF ALL KINDS



ALL TYPES

ENGINEERS, DESIGNERS AND MANUFACTURERS

COMPLETE EQUIPMENT FOR

GRAY IRON, CAR WHEEL AND PIPE FOUNDRIES

MALLEABLE AND STEEL CASTING PLANTS

1300 IN USE

Catalog "F" on request

See our Operating Exhibit at Model Foundry, World's Fair

WHITING FOUNDRY EQUIPMENT CO.

GENERAL OFFICE AND WORKS: HARVEY, ILL., U. S. A. (CHICAGO SUBURB)

THE FOUNDRY

Vol. 25, No. 2. *CLEVELAND, OHIO, OCTOBER, 1904.* *Whole No. 146*

Points of Interest to Foundrymen at the Louisiana Purchase Exposition.

Naturally the foundrymen's interest will center about the Model Foundry, which has been put up with the intention of using it as foundrymen's headquarters during the Exposition. The construction of this building was greatly delayed, first, by the lack of funds and later by bad weather, but it has been completed and is now a very creditable exhibit. The Model Foundry is to be run in connection with the coking tests which the government is carrying on in the Gulch, and for this purpose three cupolas have been installed, two of the Whiting make, furnished by the Whiting Foundry Equipment Co., and one Colliau, furnished by the J. S. McCormick Co., of Pittsburg, Pa.

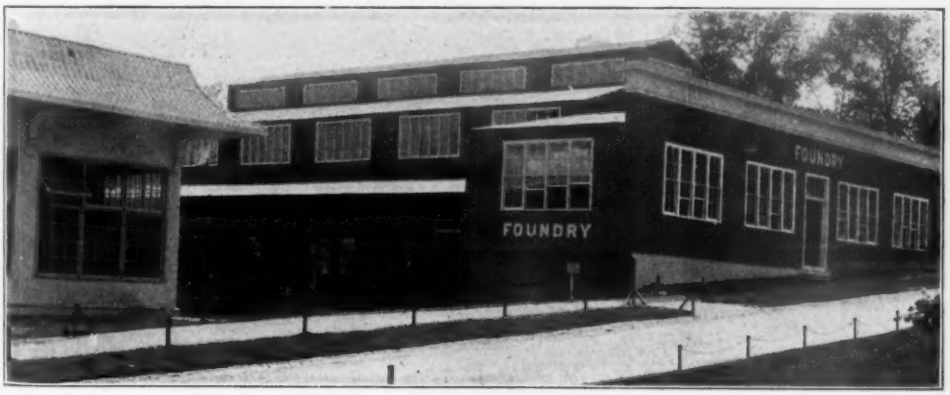
The general ground plan of the foundry building has already been published. In the construction these original plans were adhered to quite closely. At the time the photographs were taken some of the exhibits were not in their final place and some changes will undoubtedly be made, but visiting foundrymen can be sure that they will find more of interest on the ground than is shown in the photographs.

The foundry trade is mainly indebted to the efforts of the S. Obermayer Co. and the Whiting Foundry Equipment Co. for the completion and equipment of the plant, on account of the fact that after other efforts had failed these two companies came to the front and carried the project through to its successful completion. Many others, of course, have exhibited in the building.

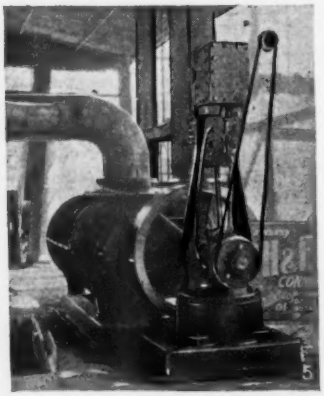
MR. MC CALPIN, SUPT. OF THE MODEL FOUNDRY.

The front room of the foundry contains the superintendent's office and various still exhibits.

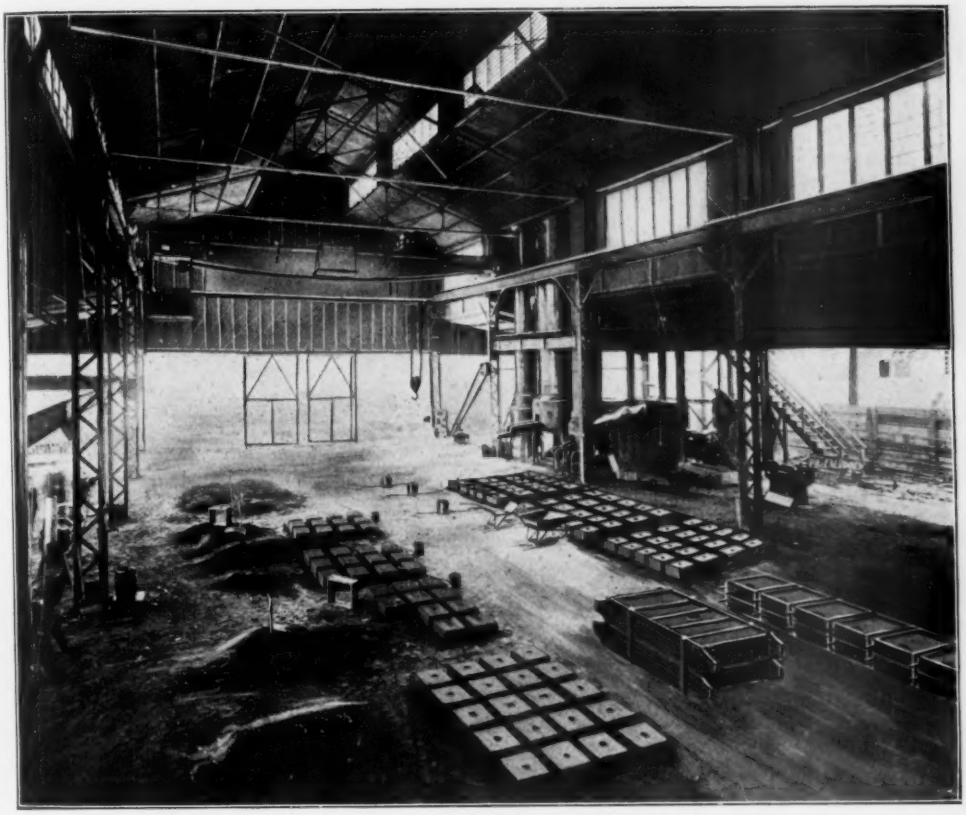
The tools and supplies for use in the foundry were furnished by the S. Obermayer Co., of Cincinnati, Chicago and Pittsburg, and in



EXTERIOR OF MODEL FOUNDRY.



1, AND 3, EXHIBITS BY THE S. OBERMAYER CO. 2, SAND EXHIBIT OF ED. E. SQUIER & CO. 4, MATERIALS FURNISHED BY HILL & GRIFFITH CO. 5, BLOWER FURNISHED BY P. H. & F. M. ROOTS CO. 6, GROUND METALS BY THE MIDVALE MINING AND MFG. CO. 7, GRINDING WHEELS FURNISHED BY THE STAR CORUNDUM WHEEL CO.



INTERIOR OF MODEL FOUNDRY.

the front room they also have an exhibit of molder's tools and supplies.

This room also contains an exhibit of castings by the Adams Co., of Dubuque, Ia., in which they show a large variety of castings

BATTLE CREEK SAND SIFTER AND CORE OVEN EXHIBITED BY THE HILL & GRIFFITH CO.

made upon their molding machines, and an exhibit of various grades of molding sand by Ed. E. Squier & Co., of St. Louis, Mo., who furnish all of the sand for use in the foundry.

This exhibit includes fine brass, stove plate, light machinery, heavy machinery, car wheel, malleable, core and white sands, as well as an exhibit of carborundum fire sand, for which the E. E. Squier Co. are agents.

AIR COMPRESSOR AND TUMBLING MILL WITH ELECTRIC MOTOR.

The Hill & Griffith Co. have an exhibit of facings and various supplies. The Midvale Mining & Mfg. Co., of St. Louis, Mo., have an

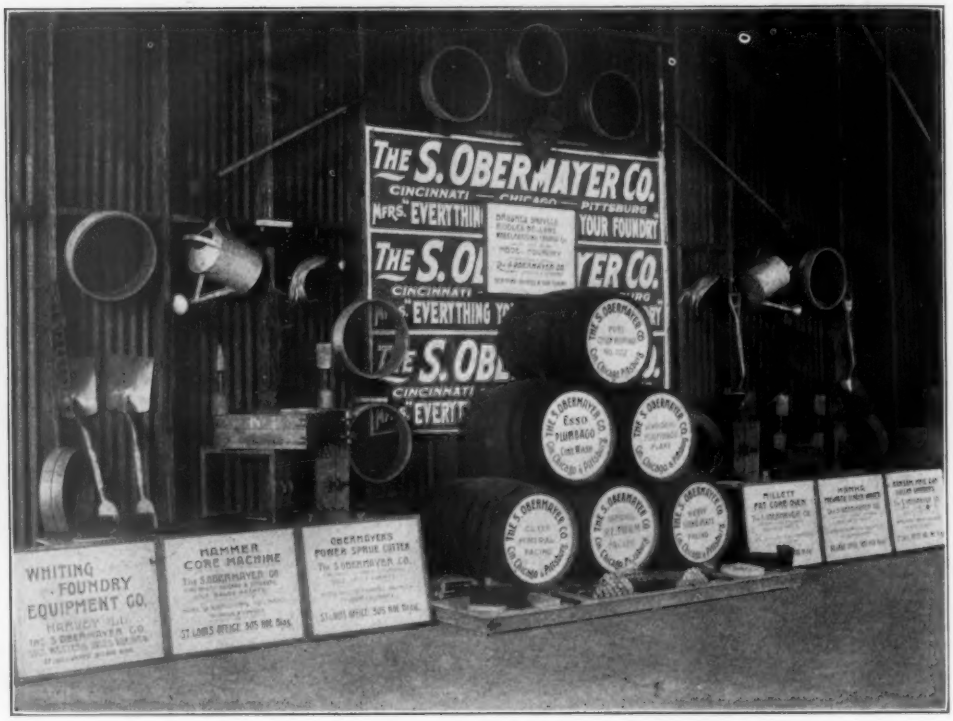


EXHIBIT OF MOLDER'S TOOLS AND SUPPLIES BY THE S. OBERMAYER CO.

exhibit of ground metals and alloys. The Star Emery Wheel Co., of Detroit, Mich., have an exhibit of wheels and in addition to this, the wheels in use upon the grinding machines in the foundry were furnished by this company.

The Smokeless Fuel Co., of St. Louis, Mo., have an exhibit of foundry coke. This company is also furnishing all of the coke necessary for the regular runs of the foundry in addition to that which will be furnished in connection with the government tests. Merritt & Co., of Philadelphia, Pa., have an exhibit of metal lockers in the front room of the foundry and another set in use in the foundry proper. W. J. Keep, of Detroit, Mich., has furnished a set of his testing machines for use in connection with foundry work.

The Whiting Foundry Equipment Co. have a large number of photographs of their products framed and hung upon the walls of the front room.

The foundry proper is divided into three bays. The central, or heavy work bay, is spanned by a traveling crane furnished by the Whiting Foundry Equipment Co. The side bay, opposite the cupolas, contains two traveling cranes, one furnished by the Whiting Foundry Equipment Co., and equipped with Yale & Towne electric hoists, and one pneumatic traveling crane furnished by the Curtis & Co. Mfg. Co., of St. Louis, Mo. The Curtis Co. also furnish an 8 x 8 air compressor, which is located in one corner of the foundry and driven from a counter shaft. The air compressor supplies air for the Tabor molding machines, the Curtis traveling crane, and also for a 4,000-pound direct acting cupola elevator, furnished by the same company.

The Curtis & Co. Mfg. Co. also have an exhibit in Machinery Hall, which includes pneumatic elevators and hoists of various types in which foundrymen will be interested. This exhibit in Machinery Hall also includes other machinery for saw mills, woodworking, etc., which do not pertain to foundry lines.

In the corner near the air compressor is also located the tumbling mill. The line shafting is driven by an electric motor, as shown in one of the illustrations.

The Obermayer Co. also have on exhibition many pieces of foundry apparatus, including a Millett core oven, portable forge, two Hanna pneumatic shaking screens, a Hammer core machine, a power sprue cutter, and an electrically operated grinding machine, which is manufactured by the Ransom Mfg. Co. and an

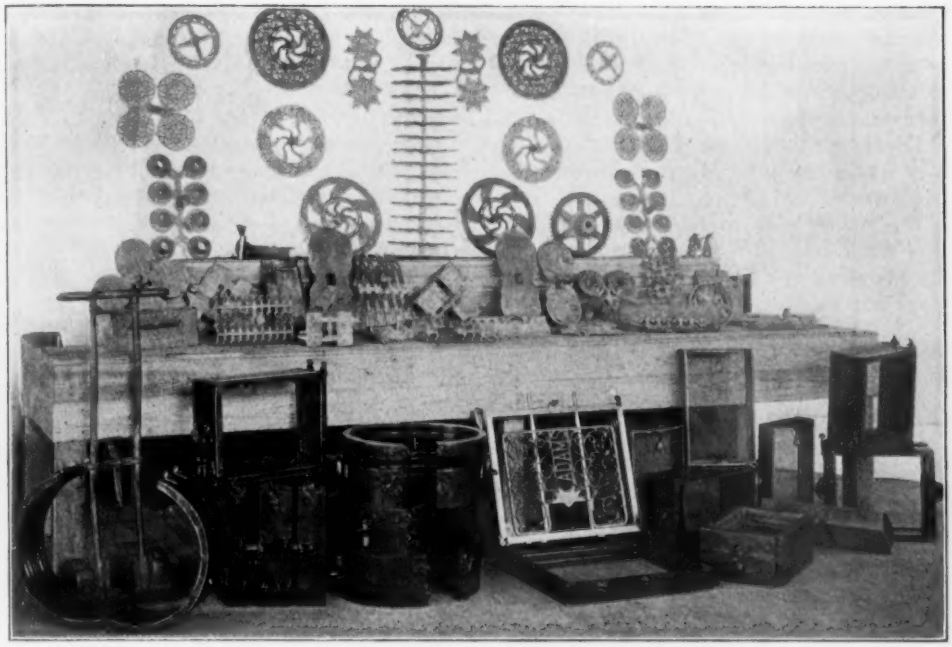


EXHIBIT OF CASTINGS AND FLASKS BY THE ADAMS CO.

exhibit of fire brick and other supplies. In addition to this the S. Obermayer Co. furnish the wheel barrows, charging barrows, and tools in use in the foundry.

The Hill & Griffith Co. have on exhibition one of their patent core ovens, a pneumatically operated Battle Creek sand sifter, and a very neat and compact exhibit, including an improved Wadsworth core machine, an emery grinder for coning cores, and a pneumatic motor for driving same.

The fire brick and fire clay for lining one of the cupolas was furnished by the Mitchell Clay Mfg. Co., of St. Louis, Mo. This is

EXHIBIT OF MOLDING MACHINES BY THE ADAMS CO.

their regular cupola mixture. In addition to this their main exhibit is situated in Block 20 of the Mines Building, where they have an exhibit of fire brick and other specialties which they manufacture.

The blower furnishing blast for the cupolas was installed by the P. H. & F. M. Roots Co., of Connersville, Ind.

The Adams Co., of Dubuque, Ia., have a very fine exhibit of molding machines, including machines of all the different types which they manufacture, together with an emery

THE FIRST IRON.

wheel stand and a tumbling mill. They have gone to the trouble of equipping all of their machines with patterns, and have several men in charge who are ready to demonstrate the use of these machines at any time. In addition to this they have a molding machine in the exhibit of the Arthur E. Barlow Malleable & Gray Iron Foundries in the Mines Building. There is also a very instructive and complete exhibit of castings, the molds for which were made on the Adams machines. The castings have the gates attached. The Tabor Mfg. Co., of Philadelphia, have one 14 in. by 16 in. power ramming split pattern vibrator molding machine, one 14 in. by 16 in. Draper-Tabor hand ramming combination stripping plate and vibrator molding machine, and one 32 in. power squeezer with vibrator frame. Other exhibits are being installed.

The construction of the foundry is unique in some respects. The building has been left open on both sides, and this space closed with special wire netting in which the wires are electrically welded at the points where they cross, thus forming a very strong and durable protection, and at the same time allowing a free circulation of air and the admission of plenty of light.

COST OF MELTING IN AN OIL FURNACE.

BY JAMES F. WEBB.

There has been more or less discussion in reference to cost of melting brass in oil furnaces, manufacturers of crucibles claiming that there is a great loss in shrinkage of metal when melting with oil.

I will try to show, however, that in using at least one kind of oil furnace there is a saving. I cannot speak for the rest, as this is the only one I have been in touch with closely enough to find out the cost of melting. I refer to the Rotary melting furnace, manufactured by a company in New York City. In the foundry I am going to use for reference they cast 3,000 lbs. a day on an average, and up to Aug. 1 used the crucible furnace. They used two sizes of pots, Nos. 200 and 150. Of the No. 200 size they used on an average, twelve a month at $10 apiece, making $120. Of the No. 150 pot, four a month at $7.50 apiece, or $30, making $150 for crucibles alone; and for coke, for 3,000 lbs. of brass will take 2,250 lbs. of coke at $5.25 a ton, which is $5.90 a day for coke; costing $153.40 a month for fuel with a loss of shrinkage of metal, averaging 2¾ percent. They melt all good brass of a mixture of 50 percent new metal and 50 percent of scrap. The new metal is copper 80, tin 10, lead 10, and small percent of phosphorus. The scrap is all railroad scrap, running in weight from ½ lb. to 30 lbs. apiece. Ten days after the furnace was running the fireman charged 1,100 lbs. of metal, 50 percent new and 50 percent scrap, and got 1,076 lbs. of castings and sprues, making a loss of 2 2-11 percent, and in the crucible 2¾ percent of loss, a saving of loss in melting. To melt 3,000 lbs. in the oil furnace at 2 gallons of oil to 100 lbs. of metal, with oil at 3½ cents a gallon will cost $2.10, quite a saving over $5.90 for coke to melt the same amount of metal. The total cost of a month's run in which 78,000 lbs. of metal was melted was as follows: When using the crucibles, $303.40,

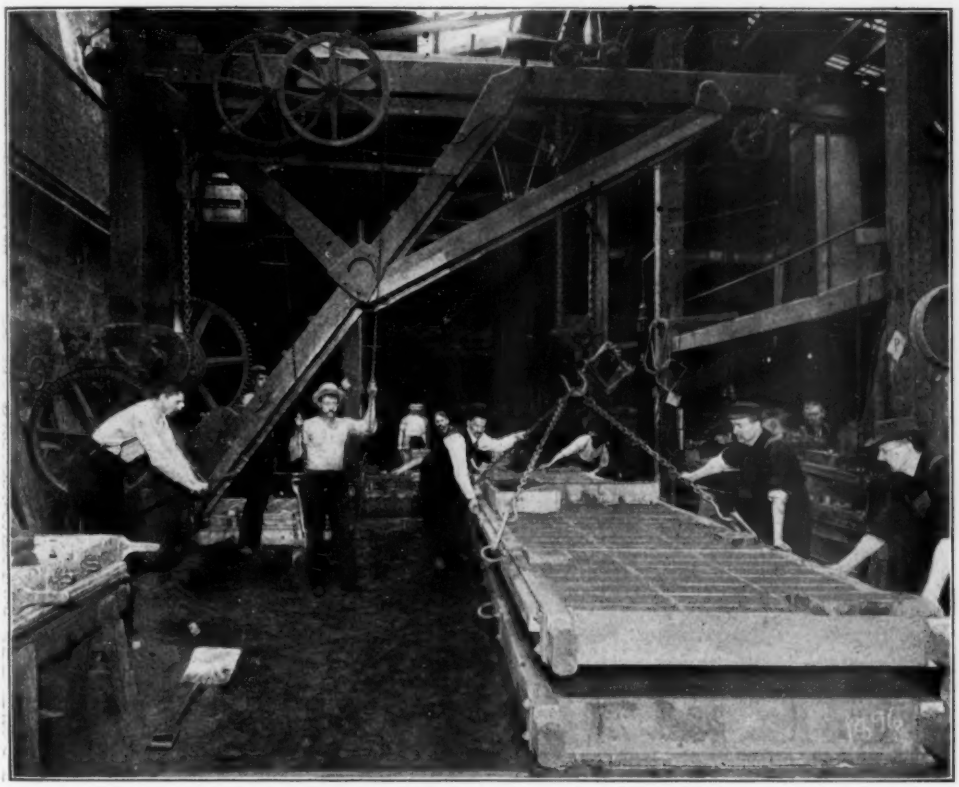
and when using the oil furnace, $54.60. The difference making a saving of $248.80 a month not figuring the cost of lining furnaces, either oil or crucible.

This oil furnace has two chambers, and while melting in one side the heat has to pass through the other side to find an outlet, and by doing so heats the metal almost to a melting point; so that in melting the second heat on the other side the cost of oil is very small, as two gallons for a hundred pounds of metal is a high figure.

The cost of the furnace is $950, all put in place and ready to melt, and the only extra cost is a small fan, say $1,000 all told. This company was using oil in their plant for other purposes, so all that was needed was to connect the pipes to their oil tank. If the oil tank had to be put in it would cost more. But to compare the two ways of melting, the furnace will pay for itself in less than four months, and besides it is not so hard on the melter, and does not keep the shop so warm. You can put your hand on the oil furnace when it is melting and not burn yourself. I am comparing this furnace to show what can be saved in melting a good grade of metal, and a fairly heavy class of work, such as building locomotives. On a very light class of work, and when yellow brass is melted, I think the crucible is the best. I would like to hear from some one else on this subject.

WILLIAMSBURG BRIDGE TABLETS.

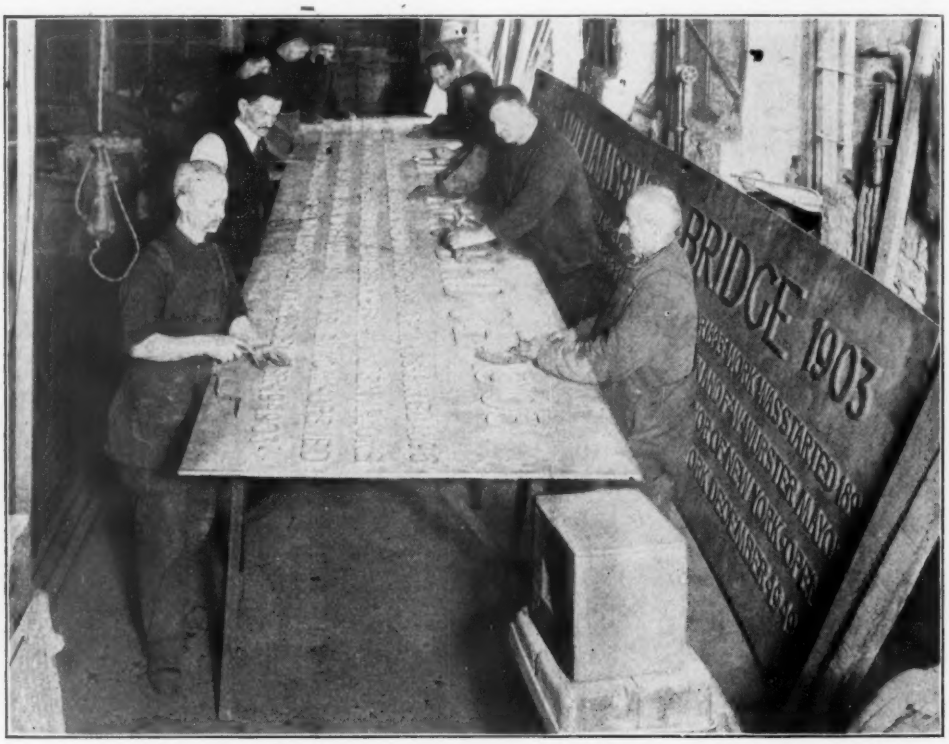
The Williamsburg bridge is not only the largest suspension bridge in the world, but to the foundryman it has furnished a very interesting example of bronze casting work. There is a large name plate or inscription plate extending across each end of the bridge, upon which are recorded the important facts concerning its construction.



MOLD FOR ONE OF THE TABLETS.

These tablets have a total length of 52 feet 7 inches, and a width of 4 feet 3 inches, and they weigh 3 tons apiece. Each tablet was cast in 3 sections, the center sections being 22 feet long, one of the side sections 16 and the other 14. These castings are extremely interesting, on account of the fact that we know

of no other case in which plates of such a large area and comparative thinness have been successfully cast in one piece. The work was done by the Wm. H. Jackson Co. at their New York foundry, 229 to 239 West 28th St. and we are indebted to Mr. S. W. Barr for the details as to the method of carrying out the work. The total thickness of each tablet was only ⅜ of an inch and hence it was quite a problem to make a wooden pattern that could be readily handled without warping. Special kiln-dried lumber was employed and the letters forming the inscription were fashioned separately and glued in place. The extent of the surface was such that each pattern was made in three sections.

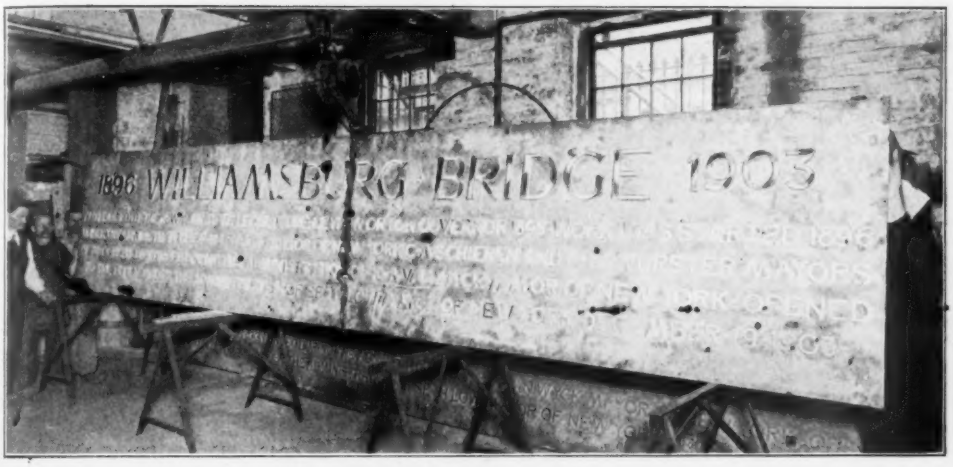


CLEANING AND FINISHING THE TABLETS.

The molding and mixing of the great quantity of metal required in the casting was no easy matter. The copper was melted in the cupola and the other ingredients of the alloy in crucibles in the usual crucible furnace. They were then mixed in the proper proportions and cast into ingots. These bronze ingots were made before the date for pouring the large casting, and when the time for pouring the casting arrived, the bronze ingots were melted in an ordinary cupola such as is used in iron foundries. In this way the bronze was melted in one large charge so that there would be little or no loss or change in composition, and a very fluid metal resulted.

In making the mold the pattern was placed on a large molding board, rammed up in the usual way and the drag rolled over. The cope was then rammed up, lifted off, the pattern drawn, and the mold skin dried by using large wire baskets containing charcoal, which were suspended from a crane over the surface of the mold. For gating the casting a runner was cut around the pattern at a distance of a few inches and a large number of small gates cut from this for running the casting. The mold was poured simultaneously from seven points so as to fill it very quickly indeed. The pouring only occupied about 8 seconds and it was only necessary to wait a few minutes until the cope could be removed. 1,200 pounds of metal were poured into the mold from a ladle carried by the crane and the remainder from hand ladles.

The accompanying illustrations show the closing of the mold, the filling of one of the



ONE OF THE COMPLETED TABLETS.

closing of the mold, the filling of one of the ladles at the cupola, the cleaning of the cast-

TAPPING THE METAL FOR TABLETS.

ing, and a view of the casting after it had been cleaned.

The Cast Thread Fitting & Foundry Co., of Auburn, N. Y., has been incorporated with a capital of $250,000. The directors are: Geo. Breed and Watson Rulan, of Philadelphia! John S. Wise, Jr., and Paul R. Clark, of Auburn; and James P. Winkle, of Seneca Falls. This company claims to control patents for the manufacture of fittings in which the threads are made during the casting process, thus avoiding the subsequent machining.

Of Course It's So.

An old fellow from one of Portland's most remote suburbs, while passing a certain hardware store in that city the other day, noticed a sign which read, "Cast Iron Sinks." The old fellow chuckled softly to himself; then, gradually, as the absurdity of it dawned upon him more forcibly, he broke into a loud guffaw. A passer-by, attracted by the apparently unseemly mirth of the old man, made bold to ask what amused him so. "Why, gol durn it," he sputtered between spasms, "ef some folkses air not gettin' to be reg'lar durn fules. The idee uv hangin' up er sign tellin' people that 'cast iron sinks.'".—[Lewistown Journal.

The first casting in the Hub City Iron Works, Aberdeen, S. D., was successfully made Aug. 21. This is the only foundry in the northern part of the state.

The Fort Payne Stove & Foundry Co., of Fort Payne, Ala., has been incorporated with a capital stock of $25,000. The incorporators are: B. J. Allen, W. C. D. Cook, S. B. Stone and J. B. Haralson. The company will manufacture stoves and do a general foundry business.

The Farmers' Co-operative Mfg. Co. was organized at Blue Rapids, Kan., a few days ago with a capital of $50,000 for the manufacturing of farm implements. This will reestablish the implement factory put out of business by last year's flood.

THE FOUNDRY.

PUBLISHED MONTHLY BY

THE PENTON PUBLISHING CO.

1060-1068 ROSE BLDG., CLEVELAND, OHIO.

CHICAGO: 1164 Monadnock Blk.
PITTSBURG: 429 Park Bldg.,
NEW YORK: 150 Nassau St.

The subscription price of THE FOUNDRY is $1.00 a year to points in the United States, Canada and Mexico. To Great Britain: Eight Shillings. Single Copies 15 cents.

Practical articles pertaining to the trade in all its branches are solicited and will be paid for.

Entered as second-class matter at the Post-Office at Cleveland, Ohio.

TRADE OUTLOOK.

During the latter part of August and the early part of September nothing of especial interest has occurred to change the general foundry outlook. A number of blast furnaces which have been idle for some time have gone into blast, and the pig iron output has been increased at a rate which would equal 2,400,000 tons increase per year. The total production during August was $1,169,407 tons or at the rate of about 13,000,000 tons per year. At the same time the merchant stocks have decreased 60,000 tons. The main part of this tonnage, however, seems to have gone to steel companies to be worked up into finished shapes in connection with orders which they were trying to close up at an early date.

The Canadian rail tariff having been put in force, all of the steel companies which had rail contracts with Canadian roads have been rushing their plants to the fullest capacity in order to deliver the rails in Canada before the time limit expired.

The coal strike in Alabama still continues to cripple the iron industry in that section. Southern iron is still quoted at $9.25 to $9.50 at the furnace for No. 2 foundry.

In the North the price of foundry iron has not changed materially, though it is claimed that some orders have been taken at a slightly higher figure. In Northern Ohio $11.75 to $12 is asked for No. 2 foundry at the plants.

A large portion of the foundry capacity is still idle, but there seems to be a persistent feeling that matters will improve shortly and that within a few months trade will pick up. It is probable, however, that the blast furnace tonnage may drop off somewhat when the steel mills have completed the rush orders which they now have on hand.

The extensive discussion concerning prices, and the changes which are being made in the prices of various steel and iron products have little or no direct effect upon the foundry situation.

FOUNDRY EXHIBITS AT ST. LOUIS.

In another part of the paper we publish a description of the Model Foundry and some exhibits which it contains. It may be of interest to review the situation somewhat. At first, it was intended that the Model Foundry should be under the charge of the American Foundrymen's Association, and in connection with this movement a subscription was started. When some of those in charge of the movement failed to obtain the required amount, they dropped the subject and threw up the problem. About this time the Exposition people agreed to put up the building and the S. Obermayer Co. and the Whiting Foundry Equipment Co. agreed to see that there was an exhibit installed. The broad-mindedness of these two concerns is shown by the fact that while they were bearing a large amount of the expense in connection with the exhibit, and doing all in their power to further it, they were nevertheless glad to welcome other exhibitors with their exhibits and assistance.

Some of the exhibitors have very creditable displays, while others have been extremely slow. The entire situation, however, has a number of rather peculiar features. It is difficult to say that any one person is to blame for the failure of the completion of any of the exhibits. For instance, one company at St. Louis offered to place men at the foundry and to do a part of their regular work there, but, owing to the extremely dull times, they were finally forced to practically close their own foundry and had no work whatever either to do at the home plant or at the Exposition. In like manner, practically every attempt to carry on manufacturing along the lines originally planned has been foiled by the dull times or lack of business.

Mr. McCalpin, superintendent of the Model Foundry, has been untiring in his efforts to bring the plant to completion, and Mr. Barker of the S. Obermayer Co., has given most of his time for several weeks to looking after the installation of the exhibits. Among other aggravating delays was the loss by the railroad company of some of the shipments and it was several weeks before they could be found and delivered to the Exposition Co.

No mention of the Model Foundry, however, would be complete without stating the fact that it is to the untiring efforts of Dr. J. A. Holmes, director of the department of Mines and Metallurgy, that the foundrymen of the country owe the existence of the Model Foundry exhibit at St. Louis.

In addition to the exhibits in the foundry building proper, a number of interesting exhibits have been installed in other parts of the grounds. In the Transportation Building are a number of exhibits of castings. In the Machinery Building there is some machinery of interest to foundrymen, also exhibits of abrasive materials and many other interesting features. The Electricity Building also contains considerable matter of interest. The Mines and Metallurgy Building is certainly one of the most interesting buildings on the grounds to foundrymen. Here are exhibits of castings by several companies, and in addition exhibits which show the various processes of manufacture of pig iron and other metals, including the ore, fuel, fluxes, metal and in many cases the finished product.

Some of the individual exhibits in different parts of the grounds have already been described in *The Foundry,* and others will be described in succeeding numbers. All foundrymen who visit the fair should not fail to call at the Model Foundry, where they will be sure of a welcome, and will find Mr. McCalpin ready to help them in any way that he can and to direct them to exhibits of interest.

USE OF MANGANESE IN THE CUPOLA OR THE LADLE.

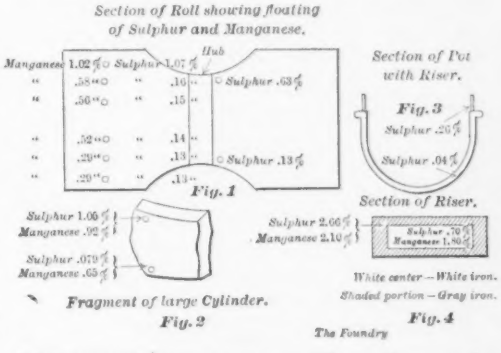
BY N. W. SHED.

The value of manganese in many castings is unquestioned. It makes a closer grain, and prevents the cutting action of many corrosive substances. Few of the ordinary pig irons go above one-half of 1 percent in manganese and to get a large percentage in the casting it is necessary to add a high manganese pig or spiegel to the cupola charge or else add ferromanganese in small lumps to the metal as it runs into the ladle. With hot metal several hundred pounds may be added in this way.

Foundrymen have usually said that it made little difference whether the manganese was added in the cupola or in the ladle, provided the ferro-manganese did not cost much more than the high manganese pig for the amount of manganese added. The question of cost will not enter the discussion for there is very little difference in expense between the two.

To test the question whether it makes any difference in the castings, a number of heats were run by adding high manganese pig to the cupola charges, and a corresponding number were run by adding ferro-manganese in the ladle. When ferro-manganese in large quantity, 200 to 300 pounds to the ladleful, was used, it was noticed that the manganese would combine with the sulphur present and carry a large amount of it to the top of the ladle. It would be possible to skim the ladle and thus reduce the sulphur considerably. The same thing is true in the casting; the melted manganese seizes the sulphur and floats it to the very top of the casting.

This was proved in many instances; the most remarkable one was the difference between the bottom and top of a 2,000-pound roll. The surface of this roll was difficult to machine and drillings made from the top of the roll showed 1.07 percent in sulphur and



1.02 percent in manganese. The roll was afterward broken and drillings made at intervals of a few inches from the top to the bottom. The results of the analysis of these drillings are shown in Fig. 1.

The iron used in this roll averaged .05 percent sulphur.

In pouring heavy cylinders the same thing is noticed. Fig. No. 2 is a sketch of a fragment of a cylinder. The upper edge of the piece showed sulphur 1.05 percent with manganese .92 percent. Ten inches lower the piece showed sulphur .079 percent with manganese .65 percent. Again in pouring large pots the risers will often show .26 percent sulphur while the body of the pot will show but .04 percent sulphur as illustrated in Fig. 3.

On one or two occasions it was observed that these risers would show white iron in the center with well defined gray iron toward the

surface as illustrated in the sectional view, Fig. 4. As this was a curious exception to the general rule, portions of each iron were tested for sulphur and manganese. The white interior showed .70 percent sulphur with 1.80 percent manganese. The gray exterior showed 2.66 sulphur with 2.10 percent manganese. When it was noted that this metal, normally, would not run over .06 in sulphur, this separation of the metalloid in the riser is remarkable.

These instances might be multiplied but they suffice to prove that ferro-manganese added in the ladle will float the sulphur to the top of the casting. On the other hand, when castings are made by adding high manganese pig to the cupola charges, no such action of the manganese is observed and there is no difference between the bottom and the top of the casting in sulphur percentage.

To avoid such irregular metal with its attendant hardness it would be well to abandon the practice of putting large amounts of ferro-manganese in the ladle. Small amounts of manganese to bring the manganese up .10 to .20 percent would do no harm and would correct any tendency to oxidation, and would give a closer grain to the casting.

At present high manganese pig, 2 to 3 percent manganese, can be bought from $1 to $2 per ton higher than ordinary pig iron, and by using 10 percent to 20 percent of this in a cupola charge, the iron is raised in manganese without the bad effect of floating the sulphur. In pouring high manganese metal a very beautiful display of metal in motion is noted. The surface seems to be covered with rosettes which continually change their position. Some speak of it as an oily film playing over the surface. It is probably caused by the action of the air on the film of manganese metal, but no explanation of it has come to the writer's notice.

In connection with the use of manganese it would be proper to state that most of the wonderful improvers of iron are nothing but alloys of manganese. Some contain considerable silicon, some have a little aluminum. A few ounces are supposed to make a good iron out of the poorest, and the promoters talk about life giving effects, regenerating influence and renovating properties. The effect is due to the manganese contained in the alloy.

A sample of one of these regenerators selling for 30 cents a pound was recently tested at the Foundrymen's Laboratory. It contained about 20 percent of manganese. A spiegel of the same percentage could be bought for less than 2 cents per pound and would have the same effect.

If ferro-manganese were added to the cupola charge it would doubtless be better for the metal but there would be danger of the strong cutting action of the manganese upon the cupola lining, and also a great waste of manganese by oxidation at the tuyeres. For these reasons the use of high manganese pig in the cupola is suggested as the best practice.

In air furnace castings the ferro-manganese has the same action as upon cupola metal and nearly all the manganese should be charged in the air furnace as high manganese pig.

The experiments referred to by N. W. Shed were carried on by the courtesy of the Buffalo Foundry Co., who offered the use of their large ladles for the purpose. The ladles carried ten tons of iron in most of the trials. The air furnace pouring over 10 tons was also used, as well as the cupola. As the cupola metal made by this company never runs above .07 in sulphur this segregation of sulphur at the top of the castings was remarkable, and the Buffalo Foundry Co. were interested in finding the cause.

AN ELECTRIC HOIST FOR FOUNDRY USE.

It is probable that nothing characterizes this age more than the large number of special appliances which are being brought out to meet special demands. The accompanying illustration shows an electric traveling crane which may be said to belong to this class of appliances. It was designed for the Altoona Wheel Foundry, of the Pennsylvania R. R. Co., by Pawling & Harnischfeger, Milwaukee, Wis.

It will be noticed that the hoist consists of a trolley running on the lower flanges of an eye beam. The hoisting hook is directly below the center of the traveling carriage, so that the load is equally divided between the four wheels. It will also be noticed that the controller and motor are placed on opposite sides of the upper sheave so as to balance each other. The hoist has been made very compact, so that it takes up an exceedingly small amount of head room.

The controller is certainly of unique and interesting construction, and is what is called an outrigger controller, permitting the operator to control both the hoisting and traveling of the carriage with one lever. A turn of the controlling bar in a horizontal plane affects the trolley travel, and the tilting of the same

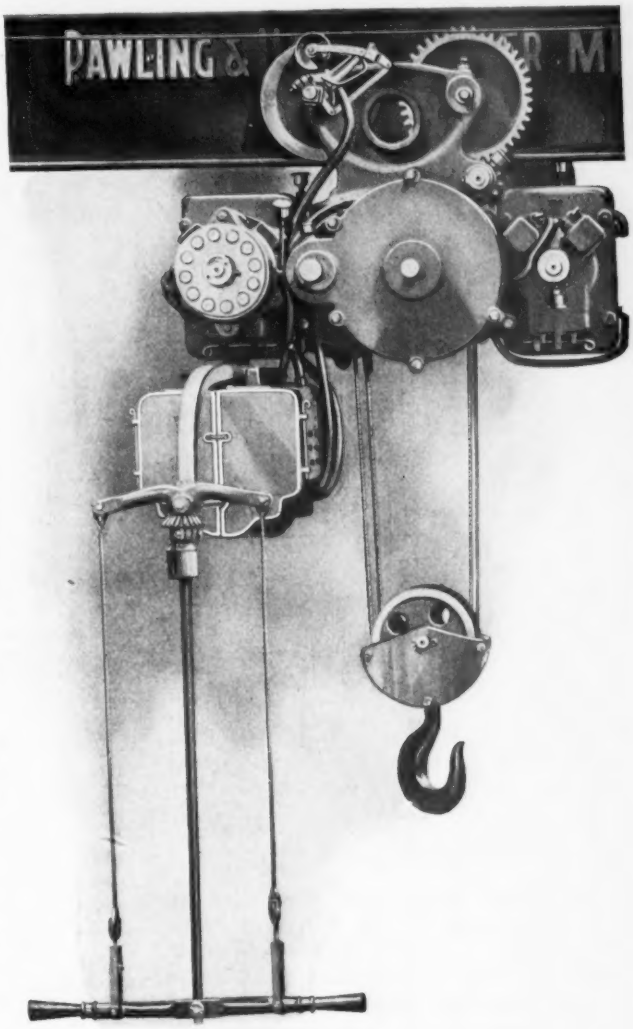
handle actuates the hoisting motor. Both motors can be reversed by simply changing the direction of movement of the bar. Both the trolley drive and the hoisting motor can be operated simultaneously. The controller connections are so arranged that the motion of one hand is in the same direction as the motion of the machine. For instance, the elevation of the right hand end of the handle bar causes the hook to raise.

The Penna. R. R. Co. are already using one of these hoists and it is their intention to install others, for handling flasks and patterns when making car wheels and also to transfer the hot wheels to the annealing furnace with the greatest possible rapidity.

The machine is capable of a maximum trolley travel of 350 ft. per minute under full load. The maximum hoisting speed varies from 30 to 50 ft. per minute, depending upon whether the hoist is being operated light, or with full load. The hook lift is 11 ft. A direct current 220-volt motor is used.

As these hoists must of necessity work in a great amount of dust and dirt the motors and other working parts are entirely enclosed. Each machine is equipped with a load brake and motor brake and a limit switch as safety devices.

One of these hoists is also being exhibited in the Electricity Building at the St. Louis Exposition, and it will certainly be found worthy of inspection by all foundrymen visiting the exposition.



AN ELECTRIC HOIST FOR FOUNDRY USE.

The Bridgeport Foundry & Machine Co., recently incorporated, has taken over the machine business of the Bridgeport Deoxidized Bronze & Metal Co. It has sufficient machinery at this time and will not be in the market. It will not build at present, but may enlarge its capacity at a later date.

The Virginia Iron Works, of Virginia, Minn., has been purchased by A. C. Osborn, of Eveleth, Minn., and C. E. Downs, Duluth, Minn., and will be known in the future as the Virginia Foundry & Machine Co. The company has been incorporated with $25,000 capital, and the incorporators are Albert C. Osborn, Edward G. Bush and Sylvester Pollock.

The foundry formerly occupied by the Seating Co., of Harrison, O., has been leased to the Campbell Corn Drill Co.

The Gartland Foundry Co., Terre Haute, Ind., will begin operations in a few days. They commence with a large number of orders on hand. The company expects to make a specialty of light gray castings for lawn mowers.

CUPOLA FAN PRACTICE. *

W. H. CARRIER, BUFFALO, N. Y.

The object of this paper is to give reliable data relative to the operation of centrifugal blowers for cupola service, including:

1. The air supply required per pound of coke used and per ton of iron produced.

2. The relation of pressure, size of cupola and speed of melting.

3. The horsepower required for various sizes of cupolas at different pressures, corresponding to different ratios of melting.

4. The relation of speed, pressure and capacity of centrifugal cupola blowers.

5. The effect of piping resistance upon the pressure and horsepower.

Considerable time has recently been spent in securing new data and many previous tests have been re-conducted, in view of a more accurate determination.

Air Supply.

The air required per ton of iron melted has been variously given from 30,000 to 33,000 cubic feet. As it is almost impossible to measure the air directly, it is necessary to resort to indirect methods of chemical analysis of the escaping gases. By analyzing a sufficient number of samples, the amount of air used in the combustion of the coke can be determined with considerable exactness. This also serves to show the nature of the gases produced. In Table I are given the results of several analyses.

Nos. 1 to 4 are from a cupola, 44 inches in diameter inside lining, operated by Buffalo steel pressure blowers at 14 ounces pressure. Nos. 5 to 10 are from a 60-inch Whiting cupola operated at 16½ ounces pressure by a positive blower. Nos. 11 to 14 are from the center blast cupola at the plant of Thomas D. West Foundry Co. This cupola is of Whiting make, measures 74 inches in diameter inside lining, and was operated by a No. 12 Buffalo blower at 9 ounces.

It will be noted that with an average of about 9 pounds of air required per pound of carbon, and with coke containing an average of 90 percent carbon, this will be 8.1 pounds of air per pound of coke. It will also be noted that in the majority of the samples, only about 50 percent of the carbon is burned to carbon dioxide; the remaining portion is burned to carbon monoxide, and liberates only one-third of its total heating value. One pound of carbon burned to carbon dioxide requires practically 12 pounds of air for combustion; the same burned to carbon monoxide requires only 6 pounds of air. In the first process 14,450 heat units are liberated, while in the second process only 4,400. From this it will be seen that in the present cupola practice less air is required than is necessary for perfect combustion; and only about two-thirds of the total heating value of the fuel is utilized; the remaining one-third escaping in the unburned carbon monoxide gases. The deeper and more intense the fire, the greater seems to be the percentage of carbon monoxide gas produced. In blast furnace practice this gas is present in quantities sufficient to make the gases highly valuable as fuel, either in the production of steam or for use in gas engines. While this discussion is somewhat foreign to the general purpose of this paper, it may be remarked that

TABLE I

Sample	Pressure	CO_2%	CO%	O%	N%	Air per lb. carbon	Air per lb. coke	B. T. U. per lb. of carbon
1	14 oz.	11.0	10.	0.6	78.4	9.15 lb.	8.1 lb.	8,530
2	14 "	11 6	10.5	2.1	75.8	9.95 "	8.8 "	8,540
3	14 "	13.4	10.4	0.3	95.9	9.3 "	8.2 "	8,800
4	14 "	11.0	14.3	0.5	74.2	8.83 "	7.8 "	7,750
5	16½ "	10.5	10.4	0.8	.....	"	.....	.....
6	16½ "	10.5	10.4	.8	78.3	9.15 "	8.24 "	9,420
7	16½ "	12.3	10.7	.9	71.	9.34 "	8.4 "	9,800
8	16½ "	12.4	10.0	.3	76.3	9.07 "	8.16 "	9,960
9	16½ "	11.2	11.9	.4	76.5	8.4 "	7.55 "	9,200
10	16½ "	12.	15.0	1.0	72.	8.57 "	7.7 "	8,850
					Aver. —	8.9 "	8.00 "	9,466
				Thomas D. West Foundry Co.				
11	9 "	15.	8.8	.4	75.8	9.5 "	8.55 "	10,700
12	9 "	12.9	10.5	.4	80.2	8.85 "	7.96 "	10,500
13	9 "	17.5	6.7	.1	75.7	9.87 "	8.89 "	11,650
14	9 "	9.3	12.2	.4	78.1	8.7 "	7.83 "	8,725
					Aver. —	9.23 "	8.31 "	10,394

* Paper read at A. F. A. Convention, Indianapolis, June, 1904.

there is an opportunity for considerable saving in fuel and a consequent increase in the melting ratio by devising some means whereby a more perfect combustion may be secured. The above test so far as conducted, would indicate that the use of the center blast tuyere, first proposed and tried by Mr. Thomas D. West, is a step in the right direction. The samples of gases taken from this cupola, except the last, show a much more perfect combustion than the ordinary side blast cupola.

From the above consideration it appears that the amount of air required per ton of iron depends upon and varies with the melting ratio. The weights and volumes of air given in Table 2 are required per ton of iron for different melting ratios:

TABLE II

Melting Ratio	By Analysis		Perfect Combustion Volume of Air Cu. Ft.
	Weight of Air Lbs.	Volume of Air Cu. Ft.	
7	2320	31,000	41,400
8	2020	27,000	36,000
9	1800	24,000	32,000
10	1620	21,600	28,000
11	1470	19,500	26,200
12	1350	18,000	24,000

The above volumes of air are estimated on an average temperature of 70 degrees. Coke is taken as 90 percent carbon.

Speed of Melting.

The pressure required to give a stated melting capacity with a given sized cupola cannot be stated absolutely with any degree of exactness. This depends, first, upon the melting ratio; second, upon the method of charging; and, third, upon the nature of the coke and iron used. In general, soft coke requires less pressure than hard coke, but does not give as good results. The speed of melting is decreased by the presence of large quantities of scrap or steel in the charge. However, if we take a standard method of charging, comprising a definite ratio of coke to iron and a definite percentage of scrap of uniform size, the variation in speed of melting which will be produced by different pressures follows quite exact laws. Taking a standard charge, the results given in Table 3 will be obtained from a 44-inch cupola, when operated at various speeds.

From the above it will be seen that the resistance to the air offered by the cupola follows the general laws of fluid friction, that is to say, the amount of air forced through the cupola will vary as the square root of the pressure. For example: If we double the amount of air forced through the cupola, then the pressure will be increased 2^2 or four times, and if the pressure is increased 9 times, $\sqrt{9}$, or three times the amount of air will be forced through. Since the speed of melting with a fixed melting ratio must necessarily be proportional to the amount of air supplied to the cupola, we will have the speed of melting varying as the square root of the pressure.

TABLE III

Pressure	Speed of Fan		Air per Min.	Estimated Melt. Capacity	Horse Power
	R. P. M.	Peripheral Ft. per Min.			
10 oz.	2151	16,193	3,100	6.0 tons	16
11 "	2254	16,966	3,250	6.4 "	18
12 "	2352	17,702	3,400	6.7 "	21
13 "	2450	18,406	3,540	6.9 "	23
14 "	2535	19,081	3,670	7.2 "	26
15 "	2620	19,730	3,800	7.5 "	29
16 "	2705	20 358	3,920	7.8 "	32

The melting capacity of a cupola with a given pressure depends upon its size and is nearly proportional to the area of the cross section; hence to the square of the diameter inside the lining. This will not hold exactly with the ordinary side blast tuyere, as somewhat larger pressure is required with the large sizes of cupolas to force the air to the center of the charge. As a result of a number of tests the following formula is determined for the average speed of melting:

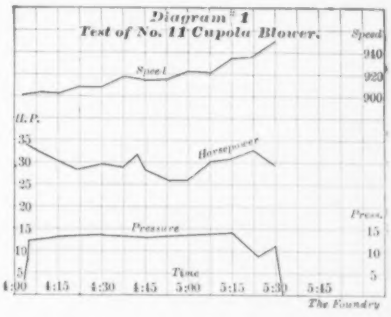
$W = 2D^2\sqrt{p}$;

W = the weight of iron in pounds per hour;

D = the diameter of the cupola inside lining, in inches;

p = pressure at the cupola in ounces per square inch.

This formula holds with a considerable degree of exactness for melting ratios of 10 to 1,



with good quality of hard coke, and for charges containing only a small amount of scrap. Variations in these conditions will of course vary the results. The air per minute required

for various sizes of cupolas may be given by the formula:

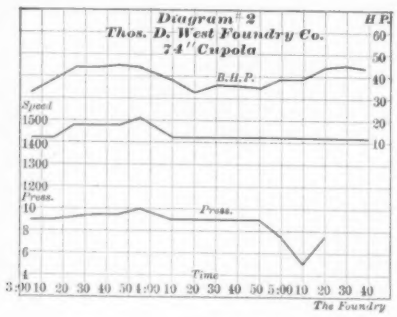
$$C = \frac{D^2 \times \sqrt{p}}{2}$$

where C is the cubic feet of air per minute required;

D is the diameter of cupola inside lining in inches;

p is the pressure in ounces per square inch.

This is a safe factor for ordinary use and gives an allowance of about 10 percent for leakage, etc. Below are given several tests



which show the results obtained under different conditions. Diagrams 1, 2 and 3 show graphically the variations in pressure and horsepower throughout the heat.

CUPOLA TEST. MAY 21, 1904

Diameter of Cupola	60 in.
Duration of Heat	2 hrs. 50 min.
Average Pressure	15.5
Lbs. Coke { Bed	2600 lbs.
Lbs. Coke { Total	9000 lbs.
Lbs. Iron	70000 lbs.
Melting Ratio	8 to 1
Coke per Hr.	3180 lbs.
Iron per Hr. (Actual)	24700 lbs.
Iron per Hr. (Formula)	28350 lbs.
Air per lb. Coke	8 lb.
Air per Min. (Actual	5680 lbs.
Air per Min. (Formula)	7088 lbs.

CUPOLA TEST. MAY 23, 1904

Diameter of Cupola	60 in.
Duration of Heat	2 hrs. 14 min.
Average Pressure	16.18
Lbs. Coke { Bed	2600 lbs.
Lbs. Coke { Total	8400 lbs.
Lbs. Iron	66000 lbs.
Melting Ratio	8 to 1
Coke per Hr.	3760 lbs.
Iron per Hr. (Actual)	29500 lbs.
Iron per Hr. (Formula)	28950 lbs.
Air per lb. Coke	8 lbs.
Air per Min. (Actual)	6673 lbs.
Air per Min. (Formula)	7238 lbs.

CUPOLA TEST. MAY 31, 1904

Diameter of Cupola	47 in.
Duration of Heat	3 hrs. 9 min.
Average Pressure	17.5
Lbs. Coke { Bed	1600 lbs.
Lbs. Coke { Total	5600 lbs.
Lbs. Iron	53000 lbs.
Melting Ratio	9.6 to 1
Coke per Hr.	1780 lbs.
Iron per Hr. (Actual)	16800 lbs.
Iron per Hr. (Formula)	18400 lbs.
Air per lb. Coke	8 lbs.
Air per Min. (Actual)	3560 @ 32° = 3950 @ 72°
Air per Min. (Formula)	4600 lbs.

BUFFALO FORGE COMPANY FOUNDRY

Diameter of Cupola	44 in.
Duration of Heat	82 Min. effect. Run 1½ hrs.
Average Pressure	16.43
Lbs. Coke. Total	2500 lbs.
Lbs. Iron	20000 lbs.
Melting Ratio	8 to 1
Coke per Hr.	1830 lbs.
Iron per Hr. (Actual)	14600 lbs.
Iron per Hr. (Formula)	15700 lbs.
Horse Power (Actual)	32
Horse Power (Formula)	33.6
Air per lb. Coke	8.22 lbs.

BUFFALO FORGE COMPANY. JUNE 6, 1904

Diameter of Cupola	44 in.
Duration of Heat	1 hr. 29 min.
Average Pressure	12.87 oz.
Lbs. Coke. (Total	2500 lbs.
Lbs. Iron	20000 lbs.
Melting Ratio	8 to 1
Coke per Hr.	1686 lbs.
Iron per Hr. (Actual)	13487 lbs.
Iron per Hr. (Formula)	13823
Air per lb. Coke	8 lbs.
Horse Power (Actual)	24.
Horse Power (Formula)	23.13

THOS. D. WEST FOUNDRY COMPANY, MAY 31, 1904

No. 12 Buffalo Blower	
Diameter of Cupola	74 in.
Duration of Heat	2 hrs. 37 min.
Average Pressure	8.68
Lbs. Coke { Bed	2250 lbs.
Lbs. Coke { Total	6750 lbs.
	1200 lbs. left over
	5550 lbs. used
Lbs. Iron	68000 lbs.
Melting Ratio	10.08 to 1 for all coke charged or 12.2 to 1 for coke used.
Coke per Hr.	2120 lbs.
Iron per Hr. (Actual)	26000 lbs.
Iron per Hr. (Formula)	32200 lbs.
Air per lb. coke	8.31 lbs.
Horse Power (Actual)	39.7 = B. H. P.
Horse Power (Formula)	36.3

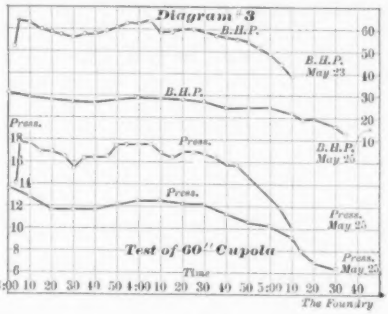
The above test was made under very unfavorable conditions. In the first place, the heat was exceedingly small for the size of the cupola. Second, the iron consisted largely of large pieces of scrap which had accumulated for some time, many pieces being of such size as to require two men to lift them. This latter condition was very unfavorable to the speed of melting. It will be noted, however, that the melting ratio was excellent. Taking into account the entire amount of coke, this is about 10 to 1; but making a deduction for the amount of coke which remained unburned at the end of the heat, the actual ratio of melting was 12.2 to 1. This melting ratio is surprisingly high considering the quality of coke used, which was unusually poor.

A very greatly increased melting ratio, however, should be expected from this type of center tuyere cupola, as the chemical analysis of the gases shows that the combustion is much more perfect than with the ordinary type of side blast cupola tested. It will be remembered that ordinarily only about ⅔ of the total heat of the coke is used. If we neglect

the last analysis, you will see that with this cupola over ¾ of the total heat of the coke was utilized.

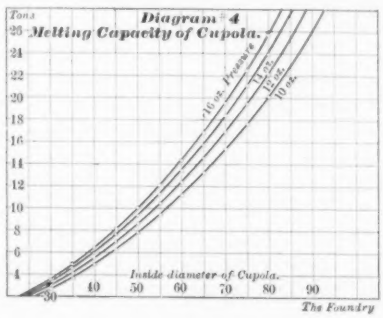
Horse Power Required to Operate Cupola.

It is usually considered that a certain sized fan, operating at a certain pressure, will require a certain horsepower. This is the usual method of rating given by makers. This rating holds very well when the fans are de-



livering the amount of air specified at the given pressures, but there is considerable fallacy in using this as the correct horsepower, when applied to cupolas in ordinary practice, since the amount of air which the blower will handle is limited by the size of the cupola; and the horsepower required to operate the fan, as will be shown later, is dependent upon the amount of air which it is allowed to handle.

Each cubic foot of air per minute moved against a pressure of one ounce per square inch, or 9 pounds per square foot, represents the expenditure of .000272 horsepower i. e.,



with perfect efficiency, 37,000 cubic feet of air per minute moved against one ounce pressure, will require one horsepower. A well constructed fan will give a maximum efficiency of about 60 percent, therefore we will have .00045 horsepower per cubic foot of air per minute per ounce pressure.

The horsepower required for any sized cupola at any pressure, is given by the formula:

$$\text{H. P.} = \frac{D^2 \sqrt{p^3}}{3800}$$

D = the diameter of cupola inside of lining in inches; p = the pressure at the cupola in ounces per square inch.

Table IV shows the melting capacity in tons, air per minute required, and horsepower to drive the fan for various sizes of cupolas, and for pressures from 10 to 16 ounces. This horsepower is the actual break horsepower. The pressures given are the actual pressures obtained at the cupola. This table is reliable, and if the fan is provided with the horsepower of motor specified and the cupola is properly managed, no trouble will be experienced from overloading. More power is required for a short time at the beginning and at the end of the heat, due to the decreased resistance at these times, but the duration is so short as to prevent undue heating of the motor. If the fan delivers air too freely at these times, the blast gates should be used to prevent overload.

TABLE NO. IV

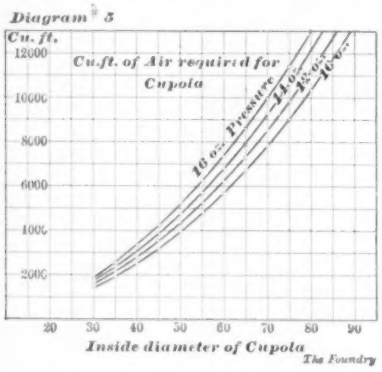
Cupola Capacities

Dia. Cupola		Static Pressure of Cupola in oz. per sq. inch			
		10 oz.	12 oz.	14 oz.	16 oz.
30 in.	Cap.	5690	6230	6730	7200
	A. P. M.	1423	1568	1688	1800
	H. P.	7.4	9.7	12.3	15.0
35 in.	Cap.	7740	8480	9170	9800
	A. P. M.	1935	2120	2293	2450
	H. P.	10.0	13.2	16.7	20.4
40 in.	Cap.	10120	11080	11970	12800
	A. P. M.	2530	2770	2993	3200
	H. P.	13.2	17.3	21.8	26.6
45 in.	Cap.	12810	14030	15150	16200
	A. P. M.	3203	3508	3788	4050
	H. P.	16.7	21.9	27.6	33.7
50 in.	Cap.	15810	17320	18700	20000
	A. P. M.	3953	4330	4675	5000
	H. P.	20.6	27.0	34.0	41.6
55 in.	Cap.	19130	20960	22640	24200
	A. P. M.	4783	5240	5660	6050
	H. P.	24.9	32.7	41.2	50.3
60 in.	Cap.	22770	24940	26940	28800
	A. P. M.	5693	6235	6735	7200
	H. P.	29.6	38.9	49.0	59.9
65 in.	Cap.	26730	29270	31620	33800
	A. P. M.	6683	7318	7905	8450
	H. P.	34.8	45 7	57.5	70.3
70 in.	Cap.	30990	33950	36670	39200
	A. P. M.	7748	8488	9168	9800
	H. P.	40.3	52.9	66.7	81.5
75 in.	Cap.	35580	38970	42090	45000
	A. P. M.	8895	9743	10523	11250
	H. P.	46.3	60.8	76.6	93.6
80 in.	Cap.	40480	44340	47890	51200
	A. P. M.	10120	11085	11973	12800
	H. P.	52.6	69.2	87.2	106.5

Diagrams 4, 5 and 6 show graphically the results given in table IV, and are very convenient for reference for sizes of cupolas and for pressures between those given in table.

Performance of Centrifugal Blower.

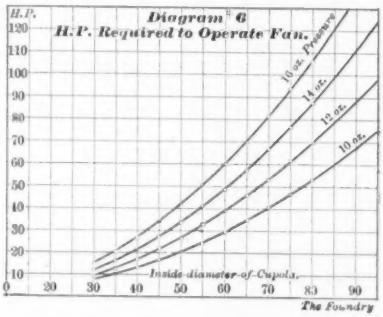
The statement has also been made that the air delivery and horsepower of centrifugal blowers at a given pressure, depends upon the size of the cupola to which it is applied. In this respect the centrifugal blower varies greatly from the positive pressure blower. With a positive pressure blower, as the resistance is increased, either by increasing the speed of the blower, or applying it to a smaller cupola, the pressure and horsepower are both increased in proportion. In the centrifugal blower, the effect upon the horsepower is reversed. With the increase of resistance the pressure is increased as in the positive blower, but the capacity and horsepower are both decreased. If the resistance against which the centrifugal blower is working is decreased, as by putting on a lighter charge, or applying to a larger size cupola, the pressure is decreased to a certain extent, and the capacity and horsepower are increased. In this respect, the centrifugal blower offers some advantages over the positive blowers. The rotary blower, while positive in action, is limited in capacity and can not adjust itself to the variations in demand for air, nor can its capacity and pressure be readily controlled by the operation of a blast gate, as with a centrifugal blower. The flexibility of operation secured with the centrifugal fan may be compared to the action of a spring. Its pressure increases in a certain measure with the increase of resistance; likewise decreases with



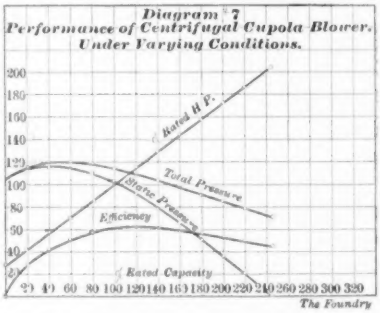
the decrease of resistance; the volume supplied varies with the conditions of pressure, and at any time all of the air is supplied which the condition of the cupola will admit. This flexibility often makes the melting capacity of the cupola with a fan blower considerably greater than with a positive blower, owing to the fact that an increased quantity of air can be supplied when required.

Another advantage of the centrifugal blower is that the same size can be applied to several sizes of cupolas, without altering the speed, and without greatly affecting the efficiency of the blower.

As a basis for comparison of the operation of a centrifugal blower under various conditions, table V gives the pressures produced and the horsepower required for a No. 11



steel pressure blower, operating at a constant speed of 1,960 revolutions, and handling various quantities of air from zero to maximum capacity at free delivery. Table VI gives the same results on the basis of capacity, pressure and horsepower at rated capacity. These tables are self-explanatory. It will be seen that the horsepower required, when running open, is about twice as much as that required when operating at rated capacity, and that when running closed it is only 28 percent as much as that required at rated capacity, or 14 percent of the horsepower required at free delivery. It will also be seen that the increase in horsepower is proportional to the increase in capacity. The pressure increases from free delivery up to about 60 percent of the rated

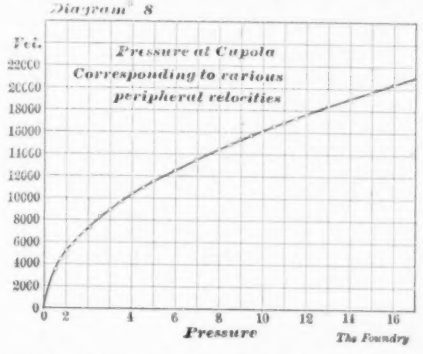


capacity; from 60 percent of the rated capacity to the closed outlet, the pressure again de-

creases, which shows that the maximum pressure is secured at 60 percent rated capacity. The rated capacity of the blower is based upon the capacity and pressure at which it will operate most economically. This is shown in the column marked Percent Efficiency; these results are also shown graphically in diagram 7.

As has been shown, the capacity under any condition is proportional to the speed of the fan, and the pressure is proportional to the square of the speed. From this it follows that the horsepower required to drive the fan will vary as the cube of the speed; for instance: suppose that a No. 11 cupola blower, operating at 1,800 r. p. m. requires 25 horsepower, when attached to a certain cupola. Now if the

Diagram 8



speed is increased from 1,800 to 1,980, or 10 percent, then the horsepower will be increased to 1.10 × 1.10 × 1.10 = 1.33 times, or an increase of 33 percent in horsepower, which will make the horsepower at 1,980 revolutions, 33.3. Also, if a No. 11 blower gives 10 ounces pressure at 1,800 r. p. m. when applied to a certain

TABLE V

Performance of No. 11 Centrifugal Cupola Blower at 1960 R. P. M.

Capacity	Pressure		Horse-Power
	Static	Total	
0	12.35	12.35	12.25
392	13.55	13.7	18.38
735	13.9	14.28	24.93
1178	13.8	14.4	31.45
1570	13.2	14.28	37.6
1960	12.35	13.8	43.73
2355	11.04	13.08	50.7
2748	9.6	12.35	56.8
3140	7.91	11.64	63.
3530	6.12	10.91	69.5
3920	4.32	10.2	75.6
2320	2.38	9.475	81.75
4790*	0.	8.7	88.3

*Free Delivery.

cupola, it will give 1.10 × 1.10 = 1.21 times that pressure for an increase of 10 percent in speed, that is, at the speed of 1,980, the pressure will be 12.1 ounces.

Table VII and diagram 8 show the various peripheral speeds of the blast wheel, required for different pressures at the cupola. For example: supposing it is required to find the speed of a blower 34½ in. in diameter; to

TABLE VI

Performance of Centrifugal Cupola Blower Under Varying Conditions

Per cent. Rated Capacity	Per cent. Rated Pressure		Per cent. Rated H. P.	Per cent. Efficiency
	Static	Total		
0	103	103	28	0.
20	113	114	42	27.6
40	116	119	57	40.8
60	115	120	72	50.4
80	110	119	86	56.4
100	103	115	100	60.
120	92	109	116	61.8
140	80	103	130	61.7
160	66	97	144	58.8
180	51	91	159	56.4
200	36	85	173	52.8
220	19	79	187	49.2
244*	0	72½	202	45.0

*Free Delivery.

give 14 ounces pressure at the cupola. Since the diameter is 34½ in., the periphery of the wheel will be 3.14 × 34½ in. ÷ 12 = 9.92 feet. From the table we find that the peripheral speed required is 19,081 feet per minute. Revolutions per minute of the fan will therefore be 19,081 ÷ 9.02 = 2,113 r. p. m.

Effect of Piping Resistance.

The piping connections from blower to cupola affect considerably the results secured. With a short straight pipe the pressure at the cupola will be practically the same as at the fan outlet. If, however, the connection is long and has a number of sharp bends, the pressure may be reduced several ounces. If the speed of the fan is not increased, the horsepower will be decreased by this resistance, but the melting capacity of the cupola will also be decreased. The pressure at the fan outlet will be slightly increased by the extra resistance offered by the fan. If, however, the fan is

TABLE VII

Peripheral Velocities Required for Various Pressures at Cupola

Pressure	Peripheral Velocity
8 oz.	14514
9 "	15378
10 "	16193
11 "	16966
12 "	17702
13 "	18406
14 "	19081
15 "	19731
16 "	20358

speeded up to secure the desired pressure at the cupola, then a considerably increased horsepower will be required to overcome the extra resistance of the piping.

Summary.

The following main points in fan cupola-practice should be emphasized:

First.—The horsepower required to operate a cupola at any stated pressure is, to a certain extent, independent of the size of the blower, so long as it has sufficient capacity to supply the required amount of air.

Second.—The melting capacity of the cupola under standard conditions, varies with the pressure according to fixed laws.

Third.—More horsepower is required per ton of iron melted, at the higher pressures than at the lower pressures.

Fourth.—At a fixed speed, the greatest horsepower is taken when the blower is running wide open, or at free delivery; the least horsepower is taken when the outlet is closed. The increase in horsepower is proportional to the increase in air delivery.

Fifth.—The piping resistance decreases the air delivery and decreases the horsepower at a fixed speed, but increases the horsepower when the fan is speeded up to give the same pressure at the cupola.

Sixth.—The centrifugal blower presents some advantages over the positive blower, from the fact that better results can be secured at lower pressures, but there is a greater uniformity of blast pressure, and it offers a flexibility in regulation. With the exception of the belting, there is but little wear or deterioration; it will give as high efficiency after running twenty years, as when first installed. On the other hand, the positive blower, owing to the friction of the contact surfaces, wears and deteriorates rapidly, and its effect while high at the beginning, decreases rapidly, owing to the leakage caused by the wearing away of the contact parts.

FAN BLOWERS FOR CUPOLA WORK.*

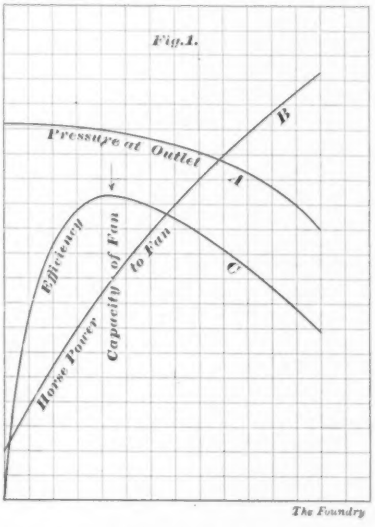
G. WM. SANGSTER, BOSTON, MASS.

A recent paper by Thos. D. West on Fan Power for the Cupola has suggested to the writer that a few notes on the principles of fan blowers might be of interest to foundrymen.

We may consider the fan, piping and cupola as forming part of what is called by Reuleaux a "Ring System" in which the atmosphere itself is the connecting link. The air is taken in at the inlet of the fan, expelled through the outlet, into the piping, thence to the cupola, up through the burden to the atmosphere and back again to the fan inlet. The atmosphere may be considered a reservoir out of which the air is taken at one opening and returned at another.

The important points in this system are the fan and the cupola burden. In the former the air is raised from atmospheric pressure to that required by the cupola and in the latter this excess of pressure is lost in passing up through the charges. Obstructions, such as sharp bends, long piping or pipes of small diameter, etc., result in a loss of pressure and therefore of efficiency. The ideal arrangement calls for a fan as close to the cupola as possible with short, straight piping of large diameter, such bends as are absolutely necessary to have long easy curves. The inside radius of an elbow should never be less than the diameter of the pipe.

A centrifugal fan will maintain a practically constant pressure while delivering air through an opening varying from zero up to an area called the "capacity of the fan." Beyond this area the pressure falls away, although the total amount of air delivered as well as



the power required by the fan are both increased. This is illustrated by the curves in Fig. 1 in which the pressure at the opening is indicated by the curve A, the power required by the fan by curve B and the efficiency by C. It will be noted that A is practically constant for a considerable variation of opening, that B has its origin above zero owing to the fact that a fan as well as any other machine takes a certain amount of power when running idle and C starts from zero, rapidly reaches the point of highest efficiency at an area equiva-

* Paper read at A. F. A. Convention, Indianapolis, June, 1904.

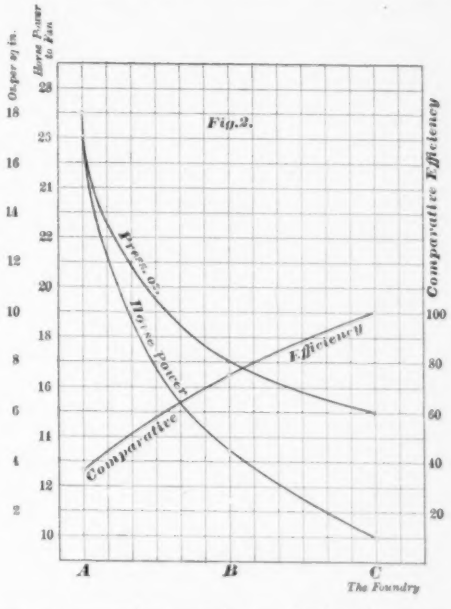
lent to the capacity of the fan and then gradually decreases. A fan blower is usually sold to deliver a certain volume of air at a specified pressure and the horsepower required is estimated for this duty. By an examination of curve A in Fig. 1 we note that the power required to drive a fan at full outlet is about twice that required when working under maximum efficiency, while the pressure falls away 25 to 30 percent and the efficiency drops to about 60 percent of that of the capacity of the fan.

With the older methods of power transmission, the fact that a fan was too small for its work was usually unnoticed; even today the fan user seldom realizes to what an extent his fan may be overloaded. Should the work put upon a blower become excessive there are two ways of correcting the trouble; one by putting in a larger fan, piping, etc., and the other and more usual method of speeding up the fan. The latter is such a simple remedy that the user does it as a matter of course, not realizing to what an extent he is squandering his coal pile.

To show the effect of overloading a blower three fans are selected, each delivering a certain volume of air through an opening at 6 ounces pressure. Two of the fans are too small for the duty and the third is of ample capacity. Fig. 2 shows the horsepowers, pressures at which the fans must be run and their comparative efficiencies. Fan A takes 27 h. p.; B 13½ h. p.; and C but 10 h. p. Estimating the cost of a horsepower per year, for a 10-hour day, at $50, it will cost $850 more per year to run A than C and $175 more to run B than C. This is due to the fact that fan A has to be speeded up to 17 ounces and B to 8 ounces in order that there may be a pressure of 6 ounces at the final outlet. C being of ample capacity is run at the proper speed to generate 6 ounces. Calling the efficiency of fan C under these conditions 100 percent we note that fan B has but 74 percent and C only 37 percent efficiency. The costs of the three fans installed ready to run are approximately A, $180; B, $225, and C, $325. By replacing A by C the original outlay will be repaid in about two months, with a future interest return of over 250 percent on the investment. By replacing B by C the original outlay will be repaid inside of seven months, with a future interest return of over 75 percent. This is on a basis of a 10-hour heat, but as average practice calls for a 2-hour heat, the cost of replacing A by C will be repaid in 10 months with an interest return of 50 percent, and fan B by C in 2½ years with an interest return of 15 percent.

Overloading fans A and B in the manner shown is just as sensible as generating steam in a boiler at 100 pounds pressure and using it in an engine at 40 pounds.

In order that a sufficient amount of air may flow through the smaller fans they have to be



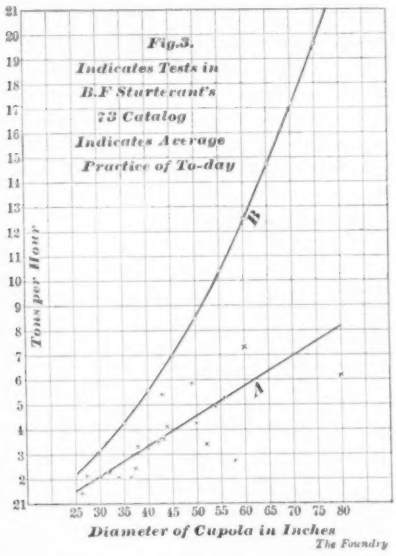
run at excessive speeds to obtain the necessary pressures and velocities for the air.

Fig. 3 illustrates the extent of progress in the melting rates of today, as compared with that of the early 70s, when Mr. B. F. Sturtevant compiled and published his series of tests on cupola practice of that time. These appear to be the first available data of the kind published in this country. It is of interest to note the very low melting rate of that period, especially in the larger sizes, as shown by curve A, and to compare it with the melting practice of today as shown by curve B. This means that the cupola is now harder driven and calls for more air and larger fans.

In order to force a sufficient quantity of air through the cupola greater pressures are required and consequently more horsepower per ton melted per hour. Better results will follow from the use of the still larger blowers. In the example mentioned by Mr. West he is running his fan at a speed of 15 ounces pressure, but the openings through the cupola burden are larger than the capacity of his fan and the pressure drops to 12 or 13 ounces in

the wind box. By putting in a fan of sufficient capacity to run at 13 ounces speed he could save about 10 h. p., or from $300 to $500 per year, depending upon the cost of power. At present he is in the position of using fan B, Fig. 2, for work which ought to be performed by a fan of the capacity corresponding to C.

Mr. West advises the purchase of a motor with a capacity equal to that required by the fan with free outlet. As a purchaser usually objects to first costs, it will take considerable selling ability to convince him that he should put in a motor of two or three times the capacity required for normal conditions. By partially shutting the blast gate at the beginning of a heat and closing it before the bottom is dropped he can prevent an overload and save on first cost. A motor is usually good for an excessive load for a short period and besides is safe-guarded by circuit breaker or fuse.



A generous allowance for the horsepower required by a fan blower in cupola practice may be obtained by the formula:

$$\frac{\text{Tons melted per hour} \times \text{pressure in ounces}}{3}$$

A 66-inch cupola according to Fig. 3 should melt 15 tons per hour. Calling the blast pressure 14 ounces we will require

$$\frac{15 \times 14}{3} = 70 \text{ H. P.}$$

Adding 20 percent for losses in motor, piping, etc., we will require about an 85-h. p. motor. Good cupola practice calls for less power than this, or

$$\frac{\text{Tons melted per hour} \times \text{pressure in ounces}}{4}$$

which will require about 52½ h. p., but the first formula is safer since it allows an ample reserve for emergencies.

In a foundry with which the writer is connected the usual melting rate is from 12½ to 13 tons per hour in a No. 7 Whiting cupola, lined to 60 inches. Blast pressure 12½ to 13 ounces, using a No. 10 Sturtevant blower which is a size larger than recommended by the cupola people; fuel ratio, including bed, about 1 to 8. The average horsepower input to fan is 35 to 40 and to motor 40 to 45. The motor is belted to fan, and power readings are easily taken. The iron requires to be hot as a large proportion of the castings are thin and light. The charges are made up with 40 to 50 percent of scrap and sprues and the balance of pig. The fan is driven by a 60-h. p. motor which is, therefore, not heavily loaded. The blast gate is controlled as already suggested.

Under similar conditions Mr. West should require for his work using a fan of proper capacity, about 45 to 50 h. p. input to the blower and 50 to 55 to the motor.

The salesman to whom Mr. West referred could not have understood the first principles of the fan blower when making the assertion that a fan took more power with a closed outlet. The principle of the fan blower is somewhat similar to that of a gravity system of waterworks supplied by a reservoir. When the flow of water is shut off there is no expenditure of power. The same holds true in the case of the fan blower, except for the power required to overcome the friction of the machinery and the revolving mass of air. As the area of the opening is increased, the pressure at the same point gradually decreases both in the gravity system and in the fan blower and both are due to loss by friction through the various passages, although in the case of the fan blower there is a further loss of pressure due to the partial vacuum generated in the inlet of the fan. This vacuum is required to provide sufficient velocity for the entering air and increases with the area of the fan outlet.

Summarizing we may note:

1. The horsepower required by a cupola should average the result obtained by multiplying the tons melted per hour by the pressure in ounces and dividing the result by 4.

2. The tons of iron per hour melted in a

cupola should average as follows: Square the diameter inside the lining in inches and multiply by .0035.

3. Install a fan of ample capacity so that the pressure in the wind box during a heat equals that at the outlet of the fan, or nearly so, when the blast gate is shut.

4. Use short straight piping of large diameter, and if necessary elbows with long easy curves.

5. Don't overload the fan; a small original investment will soon pay for itself.

6. Doubling the speed of a fan practically doubles the volume of air delivered, at four times the pressure, but it takes *eight times as much power.*

SOME CASTING PUZZLES.

BY H. KAROW.

Frequently the man who looks after the patterns in the foundry runs into problems which puzzle him almost beyond measure, and it is only by a series of experiments that the difficulty is avoided.

Cold shuts or miss runs of the iron are often blamed or the molder, with good reason. But these same troubles can arise from dull iron, too hard ramming, too much new molding sand, too wet molding sand, or from the sand being of finer grade than that required for the work.

The pattern for a required malleable casting is shown in Fig. 1, there being two patterns to one gate. These were small pieces between 8 and 9 inches long and they gave us a great deal

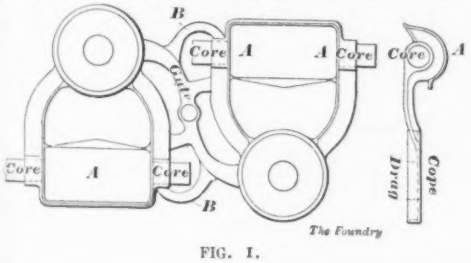


FIG. 1.

of trouble before we succeeded in making it satisfactorily. Some of the molders who quit the job blamed it on the pattern. The mold was made on the machine and I was told to see what could be done to help out the molder.

First, I introduced an extra gate, as shown at B, so as to fill the mold quicker, and there was then so much gate that the molder had difficulty in keeping his sprue full while pouring, but, nevertheless, from 30 to 50 percent of the castings were misrun, being open and full of blow holes or cold shuts at the point A. We then tried molding it upside down, but this did not help. Next, a coarser grade of molding sand was tried, and, to our delight, an improvement was noticed, but, nevertheless, many of the castings were bad. Finally, an old molder was put on the job and he made castings and had no misruns. The first thing he asked me for was to make a vent wire from the spoke of an old bicycle wheel. I made him a fine wire about 1-32 of an inch thick, leaving it blunt on the end, so that it would not injure the pattern. When the cope was rammed up, he vented it well above the point A and had no

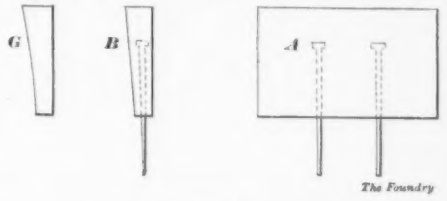


FIG. 2.

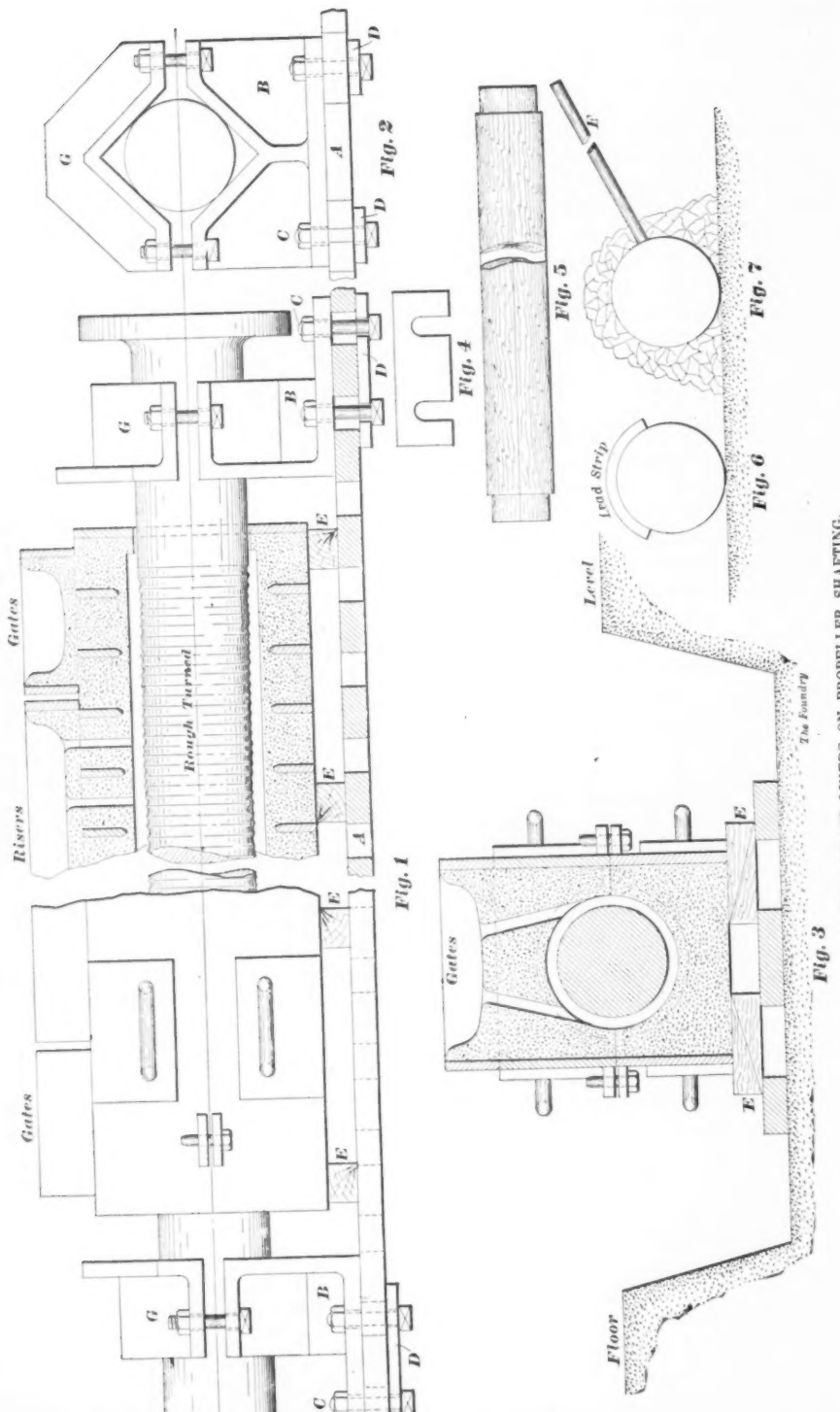
misrun castings. When I saw this, I took the gate B off again, and found that it worked just as well without it.

Another little casting that caused us considerable trouble is shown in Fig. 2. Due to shrinkage, this persisted in going concave on the side shown at G. A chill was tried against this face, but without much success. Finally, the molder simply stuck two nails in the mold as shown at A and B, and after that the castings came all right. We have no explanation for the matter, but know that the nails did the work.

John W. Nolan, Thos. P. McMahon, T. C. Latimore, E. P. Noland and others, of Chattanooga, Tenn., have organized a foundry company with a capital of $5,000. They have leased the old Phoenix foundry building on Boyce street, and the building will be equipped with machinery of the latest design to carry on a general foundry business. The machinery has been ordered. John W. Nolan will manage the plant.

The Cypress City Foundry & Machine Shops, Plaquemine, La., have been incorporated with a capital of $10,000. Edward Miremont is president with the following board of directors: F. J. Robertson, Eugene Poche, Talbot Roth, J. Wade Landry, M. Pompaneaux and Sidney O. Labauve.

The Kerr & Coombes Foundry Co., of Walkerville, Ont., has been incorporated with a capital of $50,000. The provisional directors are: W. J. Kerr, Geo. Coombes, W. H. Kerr, and W. Coombes.



CASTING BRASS LINERS ON PROPELLER SHAFTING.

CASTING BRASS LINERS ON PROPELLER SHAFTING.

BY A. URQUHART.

As quite a number of owners insist on having the liners cast instead of being shrunk on, it becomes necessary for every well-equipped shop to have some special plant for that purpose. Fortunately, the articles required are few in number and of an inexpensive nature, the shaft we propose dealing with in the present instance being 13 inches in diameter and about 18 feet long, with the liner cast in the middle of its length. The length of the liner is 12 feet and the outside diameter 15½ inches. Fig. 1 shows an elevation partly in section of the finished mold with the shaft in position. Fig 2 an end view, and Fig. 3 a cross section. The first part to get in hand will be the foundation plate A, Figs. 1 and 2. The length of this plate may be anything from ten to twenty feet, according to the class of work that is being done. In this instance it is 20 feet long, 3 feet 6 inches broad and about 3 inches thick. Two rows of rectangular holes, 8 by 4 inches, are cast in it throughout the entire length, as shown in Figs. 1, 2 and 3. An excavation is now made in the floor about two feet deep and the plate firmly bedded down into it, care being taken that it is laid down level. Two stools B, Figs. 1 and 2, with the holding down bolts C in position, are now placed on top of the foundation plate, the space between them being about one foot more than the overall length of the molding box, so as to give six inch clearance at each end. The heads of the bolts C pass through the holes in the foundation plate and into the small malleable iron plates D, Figs. 1 and 2. By referring to the plan of these plates, Fig. 4, it will be seen that the holes are D shaped, so that they may be put in position from the under side of the foundation plate. The stools are now firmly bolted down, and the drag or bottom half of the dry sand mold, which has been made from the pattern, Fig. 5, is placed between them. It will be noticed that the prints on the pattern are slightly larger in diameter than the shaft, so as to avoid the possibility of the mold being damaged by contact. Two lead strips are now cast the same thickness as the liner and bent round the shaft to give them the desired curve (see Fig. 6). They are then placed in the mold, one at each end, with a piece of sheet tin under them to prevent them from sinking into the sand. We now place the shaft in the stools and lift the drag up until the lead strips come in contact with the shaft. The wedges E, Figs. 1 and 3, are then driven in for the purpose of keeping the mold in position. Clay thickness strips are then placed on top of the shaft, one at each end and one at the center, and the top part lowered into its place. If on the removal of the top part the clay strips are found to be the correct thickness, the shaft may be taken out and heated. To do this, place the shaft on a level bed of sand and build a coal fire round the part to be heated (see Fig. 7). While the shaft is being heated we may fill up the pit with sand, ramming it down hard until it is up to the floor level. Care should be taken that the shaft is not overheated, as it would be liable to bend or sag when lifting it into the mold. It should not be heated to more than a dull red. The condition it is in can be readily ascertained by placing the end of a tube F against it and looking through (see Fig. 7). When the shaft is replaced in the mold the stool covers G, Figs. 1 and 2, are bolted down hard for the purpose of lessening any tendency that the shaft may have to bend or sag at the center.

When the top part has been lowered into position, it will be found necessary to seam up the ends of the mold, owing to the prints on the pattern being a little larger in diameter than the shaft. This is usually done by first packing the opening with a strand or two of hemp rope and finishing off with soft loam. The purpose of the rope is merely to prevent the loam from getting into the mold. By referring to the diagrams it will be seen that the mold is gated at both ends, with the risers closely spaced along the whole length. All we need see to now is that as little time as possible be lost between the final placing of the shaft in the mold and pouring.

CUPOLA PRACTICE.

BY HARRY WILLIS.

Note by the Editor: This article is of especial interest to American foundrymen, as it represents practice in one of the best foundries in New Zealand.

This subject has been dealt with so often in *The Foundry* that I feel some diffidence in giving an expression of opinion, and certainly would not do so had the various writers been sufficiently explicit on these very important points. How long after the fire has been lit should the furnace be charged, and how soon after the furnace has been charged should the

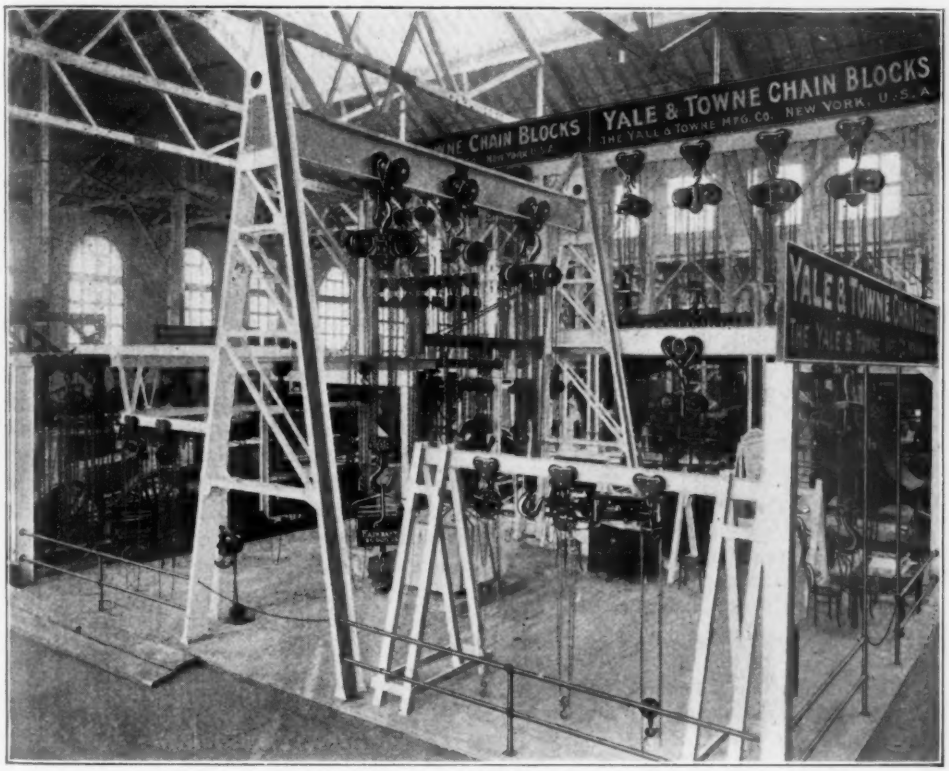
blast be put on? I consider these two points of vital importance in cupola practice, as the rapidity with which the metal is melted and the heat of the metal depends in a great measure upon them. I am not sufficiently self-opiniated to lay down the law for the whole universe in cupola practice, I am simply giving my experience in connection with this matter in the hope that it may interest and possibly prove of some use to some of the readers of *The Foundry*. In a general jobbing foundry it very often occurs that a considerable portion of the floor will be filled with light work requiring very hot metal, while the remainder will comprise castings ranging perhaps from five to six hundredweight to five or six tons, for which the metal will be required much quicker than the first part of the cast, but not quite as hot. Under such circumstances I have invariably had success by adopting the following method: When the furnace had been prepared and the bottom laid, put in the shavings, with sufficient wood to insure a good light, then cover to a depth of about 15" with soft coke or coal, then light the fire. When the fire has got a good hold of the coke, put in the remainder of the bed, which should consist of good hard coke and should extend to at least 22" above the tuyeres. Then go on charging right up to the charging door, using a layer of about 3" of coke between each charge until sufficient metal has been put in the furnace to cast the light work, then reduce the coke to just sufficient to cover the iron. Immediately the furnace is charged to the door, put the blast on and continue to keep the furnace charged to the door until the last of the metal is in. If the cast is a long one, extending from three to four or five hours, increase the coke between every seventh or eighth charge in order to replenish the bed, otherwise the metal will find its way to the tuyeres and cause trouble owing to the fact that the original bed has been consumed and has not been replenished. If on the other hand our cast consists of castings ranging in weight perhaps two hundred pounds and upwards, when the metal is required quickly, but not so hot as in the previous illustrations, we charge the furnace in a similar manner, but we do not put the blast on until one hour after the furnace has been charged, with the result that the metal will make its appearance at the tapping hole in about five minutes after the blast is put on and the remainder of the metal will come down very rapidly, right through the cast, providing the furnace is kept fully charged and care is taken to keep the metal from the tuyeres by putting in an extra charge of coke occasionally. The explanation of the difference in results obtained will, I have no doubt, be very readily understood by any practical moulder who has given the matter any consideration. In the first instance the blast being put on as soon as possible after the furnace has been charged produces an intense heat at the melting zone immediately under the first charge before the second and third charges are red hot, with the result that the charges are melted in succession and you can depend upon getting good hot metal right through. Our cupolas are 36" inside diameter, and our minimum melt working the furnace on these lines is eight to one. As the procedure in the second illustration quoted is directly opposite to that observed in the first, so also is the result. The blast not being put on until one hour after charging, gives sufficient time for all the charges right up to the door to become heated, in fact the bottom charges are in almost a molten condition when the blast is put on with the quite natural result that the metal melts very quickly, but is, as I have previously stated, not so hot as in the first instance, because a large proportion of the heating powers of the coke has been used in heating the furnace through before the blast was put on. Our average melting ratio working on these lines is from 12 to 13 to 1. The size of the charges we use are in the first case 672 pounds and in the second 896 pounds.

I have no doubt there are many very experienced foundrymen who will question the correctness of my figures in this connection, but I would ask them most respectfully to make a few experiments on these lines first and then start to criticise afterwards. When the furnaces came under my control they were worked on the very old-fashioned principle of two swan-necked tuyeres leading directly into the furnace one on either side, while the furnaces themselves rested on brick foundations, the results obtained from them were very unsatisfactory indeed. To obtain better results it was necessary to make an alteration, so we raised the furnaces and placed them on columns, added wind belts and drop bottoms, increased the diameter of the pulleys on the driving shaft of the blower which gave us greater velocity; the results were very satisfactory and amply compensated for the expense. I have taken a very lively interest in these furnaces ever since, as I considered my-

self personally responsible for their success or failure, and I consider my time and trouble has been well spent. We have been working them now for nearly six years and if they receive the same care and attention in the future they will be efficient at the end of the next six years. Every foundry foreman should thoroughly understand his furnaces. Therefore he should notice every point from putting in the bottom to the last charge. He should also note every apparently slight variation in increasing or reducing the size of the charges, the time when the furnace is lighted, when the blast is put on, when the metal is down, when the bottom is dropped, and the amount of metal melted. It is only by close and constant attention to these points that he can become proficient in cupola practice and obtain a thorough knowledge of the capabilities of the cupolas with which he is working.

A CHAIN HOIST EXHIBIT.

The Yale & Towne Mfg. Co. have a very interesting chain hoist exhibit at the St. Louis exposition. It is shown in the accompanying halftone. There are a number of novel features in this exhibit. One is that they have the three different types of hoist arranged so that they are driven by electric motors and are lifting equal weights. By looking at the ammeters for the three motors and noting the time of hoist a very graphic comparison of the relative efficiencies of the three hoists can be obtained. All of the different classes of hoists made by this company are included in this exhibit.



A CHAIN HOIST EXHIBIT.

The Racine Boat Co., Muskegon, Mich., is constructing a new foundry 60 x 120 ft., with an annex to be used as a brass foundry. The building will be equipped with machinery used in the company's old plant at Racine, Wis.

The plant of the Southern Car & Foundry Co. at Binghamton, near Memphis, Tenn., has been sold to the American Car & Foundry Co. The receivers are taking active steps in winding up the affairs of the company. The plant at Lenoi City has been sold and the one at Anniston, Ala., has been returned to the former owners. The sale of the Memphis plant leaves only the plant at Gadsden, Ala., on the receivers' hands.

PERCENTAGE METHOD OF DETERMINING PRODUCTION COSTS.

BY HARRINGTON EMERSON.

At one time I was manager of a company casting about three hundred and fifty tons net a month of a great variety of product. I wanted to know the costs. It did not take long to make beautiful diagrams of all the different items, and to determine accurately not only what the output was costing per pound, but also just what percentage of cost belonged to each general division, such as materials, power, general expense, general factory charges, labor of each and all kinds; and I was pointing with pride to a slowly diminishing cost and increasing production, when I was rudely awakened by a letter from the president of the company stating that whatever my beautiful diagrams and tables might show, profits were steadily diminishing in spite of selling prices remaining constant.

In vain did I examine my diagrams and tables, in vain did I protest that my figures were reliable. The brutal facts of the bookkeeper were against me.

I found that I had not gone far enough, that the mere knowing the cost per ton of castings was on a par with the half knowledge of the boy who thinks he can swim sufficiently well to go into deep water, yet finds that he does not know enough to keep from drowning.

The next step was to determine the separate cost of every single article made, and to do this so accurately that the cost of all the separate items exactly balanced the total cost of operation. Having done this, we discovered that at current prices there was a large profit on certain classes of output, and a severe loss on others, and thereafter it was wholly within the power of the manager to make a good or poor monthly showing by selecting for delivery the profitable or the unprofitable classes. This, however, came near proving my undoing, and the pit I digged for another I just escaped falling into myself; for, my term of engagement drawing to an end, and my successor having been appointed, I tried to close my last month in a blaze of glory, and so skimmed the cream from the orders, keeping all hands busy on the fattest I could find. The month did show up well, but it was not so pleasant when I was asked to stay another month and break in the new manager. On the lean stuff left, on which deliveries could not be further postponed, it took hard and driving work to maintain my own record.

A general method of determining the cost of each separate kind of output cannot be taught, as it will vary in every separate case; nor is a particular method of great importance, provided the results are approximately accurate, and provided that the total ascertained costs of everything produced equal the costs of operating the concern.

In the present crude state of factory records, there is a final accuracy that is silly because it is vitiated by glaring inaccuracy in details; but there is also a common sense accuracy most valuable, because it does apportion and distribute all the costs.

In the plant in question, the method used to determine costs of each article was to assume that the factory was running exclusively on one article for a whole month, and to charge all costs to the hypothetical tonnage. After working up our tables on this basis, we found that our theoretical costs figured on the actual production, tallied to within a few dollars with the actual outlays. As kinds of production constantly varied, no better proof could have been obtained of the great reliability of the method.

It is, however, not always possible to ascertain costs in this manner, and particularly not in a jobbing foundry casting everything from ten ton castings to chicken feed. The variations of conditions are too great to permit equitable apportionment, except as to material and direct labor.

In such a foundry the following method was followed with gratifying success. A card was made out for each different kind of casting during the month. The master founder, a man of great experience and unusually good judgment, was requested to estimate the labor and material costs per hundred pounds of each carded article. His prices covered a range from $1.00 to $7.00.

The aggregate of all labor and material was already accurately known, and the total estimated values were compared with the actual costs. The two totals were exceedingly close, differing only by a few dollars. This spoke well for the judgment of the master founder, but for the success of the method such accuracy is not essential. The wildest guesses could very soon be corrected to reliability.

To aid judgment, the actual labor costs of a few typical products are carefully ascertained, this being a very different and much

easier matter than an attempt to determine the cost of all products. These typical cases act as checks and correctives for the master founder's or manager's subsequent estimates. With the priced cards, an accurate entry can be made of the total factory cost of every single article on the percentage method, as illustrated by the following figures:

Bookkeeper's foundry payroll	$ 2,400.00
Bookkeeper's net material used, 300 tons	4,800.00
Bookkeeper's all other expenses	6,300.00
Total foundry costs per month	$13,500.00
Total product as priced in detail by founder	$ 7,415.00
Percentage to be added to balance bookkeeper's total, 82%	6,080.30
Total estimated costs	$13,495.30
Amount to be carried forward to balance books	4.70
Total foundry costs	$13,500.00
Total product	600,000 lbs.
Average price per 100 lbs	$2.25

To the price made by the founder, whether $1.00 or $7.00 per hundred pounds, add 82% to arrive at total cost of piece.

Selling prices are, however, not made at the whim of the foundry owner, but by competition.

It may, therefore, happen that 82% will carry certain classes of work above competition prices, and carry other classes unnecessarily below competition prices. The foundry owner may therefore set out his classes from $1.00 to $7.00, and assign a different percentage to each, provided the totals of all classes, with percentages added, equal his bookkeeper's totals, as per the following example:

1ST METHOD—FLAT PERCENTAGE.

Class.	Founder's price.	%	Cost per 100 lbs.	Total.
A	350,000	$1.00	82%	$1.82	$ 6,370.00
D	247,000	1.50	82%	2.73	6,743.10
H	3,000	7.00	82%	12.74	382.20
					$13,495.30

2D METHOD—VARIABLE PERCENTAGE.

A	350,000	$1.00	50%	$1.50	$ 5,250.00
D	247,000	1.50	106%	3.09	7,632.30
H	3,000	7.00	200%	21.00	630.00
					$13,512.30

Woe betide the foundry owner who to meet competition lowers his percentage on class A, and omits to raise it on classes D and H.

The above outlined method not only permits all the usual and valuable monthly comparisons of cost of material, costs of all the different divisions of expense on a tonnage or any other basis, but manipulation of the percentages keeps the foundry owner in closest touch with the to him essential facts, namely the cost of each separate article, and the selling prices which will enable him to cover his actual expenses. The master founder's estimate is the real cost. The overcharges are distributed, not by some fancy accounting method, but according to the exigencies of competition.

It can be very soon ascertained whether competition prices are below a reasonable and proper value, in which case the sensible foundry owner will refuse to follow. If competition prices in class A are so low that they can not be averaged up by higher prices in classes D and H, it is time to let the competitor take the whole A business, or so to revise methods as to bring costs down.

The monthly cost sheet of all the various castings of a foundry can be made out in a few hours, and I have seen the system so perfected in one establishment that each morning at 9 a. m. a complete balance sheet was presented of the cost and selling value of the previous day's product.

The percentage method of working from a basis of elementary labor and material costs upwards to the bookkeeper's entries, is applicable to many lines besides foundries.

Costs are one thing, selling prices another—and the captain of industry is the man who knows how to steer safely between them, never selling below cost and never asking more than competitors.

NOTES ON THE CORE ROOM.

BY CHAS. A. SMITH.

Few managers realize the importance of the core room in its relation to the foundry, and I hope that these notes will assist in impressing upon the minds of such the importance of careful work in this department. In many shops the core room is in some remote or out-of-the-way place, whereas it ought to be as well located as the cupola itself. In building a foundry one should always give careful consideration to the position of the core room and its equipment. The ovens should be the best obtainable, and fired either with gas or coke. A judicious selection of good tools will save hun-

dreds of dollars if properly used in this department. I should also advise all foundrymen to introduce a stock room for such cores as are in constant demand. This will enable the core room to always keep ahead of the molders. The molders are the producers and if they are forced to wait for cores or to use cores which are not properly made it will result in seriously curtailing the foundry output. When a molder has to wait for cores he will frequently take those which he knows are improper and run the risk of losing a casting rather than put up less than his customary number of molds. Where a stock of cores is on hand the molders will always reject all bad cores and it will be found cheaper to grind them up than to lose castings by attempting to use them.

Cores should never be used hot, as a hot core draws dampness from the mold and is liable to cause a core blow. We make all of our cores with oil, as the oil core stands more rough handling than the resin or flour core or a core made from any compound core powder. This makes the oil mixture the cheapest, on account of the fact that far less cores will be lost. Oil makes a harder core and a smoother casting and is the only mixture that can be used where old cores are to be worked in. We have a machine that crushes all old and broken cores so that we can utilize the sand in our regular mixture. Where oil cores are used, less rods or wires, and in some cases no rods or wires will be necessary. Another advantage is that the oil core does not require blackening, as a flour core does. Oil is a little harder to mix and can only be mixed thoroughly with a regular sand mixer. A superintendent asked me recently about the use of old cores, and stated that his core foreman refused to use them. I told him "it can be done, as we are doing it successfully every day, and it is a great saving to the firm."

MOLDING MACHINE PRACTICE.

BY F. W. HALL.

In Fig. 1 is shown a ratchet wheel which makes an interesting piece for arranging on a molding machine. It is necessary to strip this piece, on account of the fact that the face of the teeth must be straight. The drag pattern plate is shown in Fig. 2. It will be noticed that provision is made for molding six patterns at once and in the top face of the plate the recesses for the stripping plates are shown. The cope pattern plate is shown in Fig. 3 with the gate attached. The stripping plate for three of the patterns is shown in Fig. 4. These stripping plates are made to fit in the recesses in the pattern plate shown in Fig. 1. A plan and section of the drag portion of the mold is shown in Fig. 7. The fitting of this pattern for the machine shown in Fig. 8 will be described. This is a Paxson Hall double Class A split pattern pneumatic molding machine. Cope and drag pattern plates and flasks are shown in section. The block is in position to ram the drag half of the mold.

The pattern is split on the line C-D, Fig. 1, the hub portion of the ratchet being put on the cope plate and the remainder on the drag plate. One of these pattern plates comes with each split pattern machine. These plates are finished all over to fit in a case on the machine. A drill jig also goes with each machine and is intended for drilling the pattern plates. The pattern plates and jigs are interchangeable, so that, if the foundry is fitted with a number of these machines, any of the plates could be used on any of the machines.

In some cases, the class A machine is made single, and in this case both cope and drag would have to be made on the same machine. If such a machine as this were at hand I would proceed as follows: First, scribe a center line on the plates as shown in Fig. 3, passing through the center of the gates. On one side of this line I would mount the three cope sections of the pattern, and on the other side three of the drag sections. Of course this would not be practical with all patterns, on account of the fact that one-half of the casting would be in the cope and the other half in the drag, and if certain surfaces were desired especially clean, there would be a risk of having half of them bad. For this reason I show no drawing of this method. In many cases where two machines are used it has been customary to put a man on each machine, but two men seldom do twice as much work as one man would, and so it is frequently advisable to let one man handle two machines, unless they are so far apart that much time would be lost in going back and forth. The advantage of the type of machine shown in Fig. 8 is that it provides two working tables close together and reduces the amount of floor space required to a minimum.

When fitting up a plate of patterns as shown in the illustrations, first lay off the center lines, as shown at E-F and G-H, Fig. 2. The plate shown is a 13¾ by 19 inch plate. In laying out this plate first place the six patterns the proper

distances from each other and from the center line, allowing space along the center line G-H for the gate. The necessary allowance must be made for letting the stripping plate into the pattern plate, the stripping plate being shown in Fig. 4. The width of this stripping plate will determine the distance these patterns are from the center line and from each other. After having determined this, the centers of the patterns can be located either by scribing lines around their teeth and locating the center, or better still, by a careful lay out from the dimensions of the wheels. When the center of each pattern has been located, a one-half inch hole should be drilled through the plate, as shown at L. Next, a one-half inch hole should be drilled in the center of the flat side of each of the wheels. This should not be drilled clear through. A specially formed sweep or cutter should be used for turning out the groove to receive the stripping plate. This should be provided with a half inch tit to enter the half inch hole L, and a sweep or cutting blade for cutting out the groove for the stripping plate, as shown in Fig. 2. The stripping plate for this work can be made of sheet brass, as shown in Fig. 4, and the grooves in Fig. 2 should be swept out just deep enough to bring the upper surface of this plate flush with the top of the pattern plate. Quarter inch sheet brass would be proper for use in the case shown. The use of the sheet brass will save planing and also save the making of a pattern for the stripping plate. Also, if the pattern should be laid away for some time and should get damp, the brass stripper will not rust fast to the plate, as an iron or steel one would. The holes for the stools should next be laid out in the pattern plate as shown in Fig. 2. The stripping plates, of which there should be two, made as shown

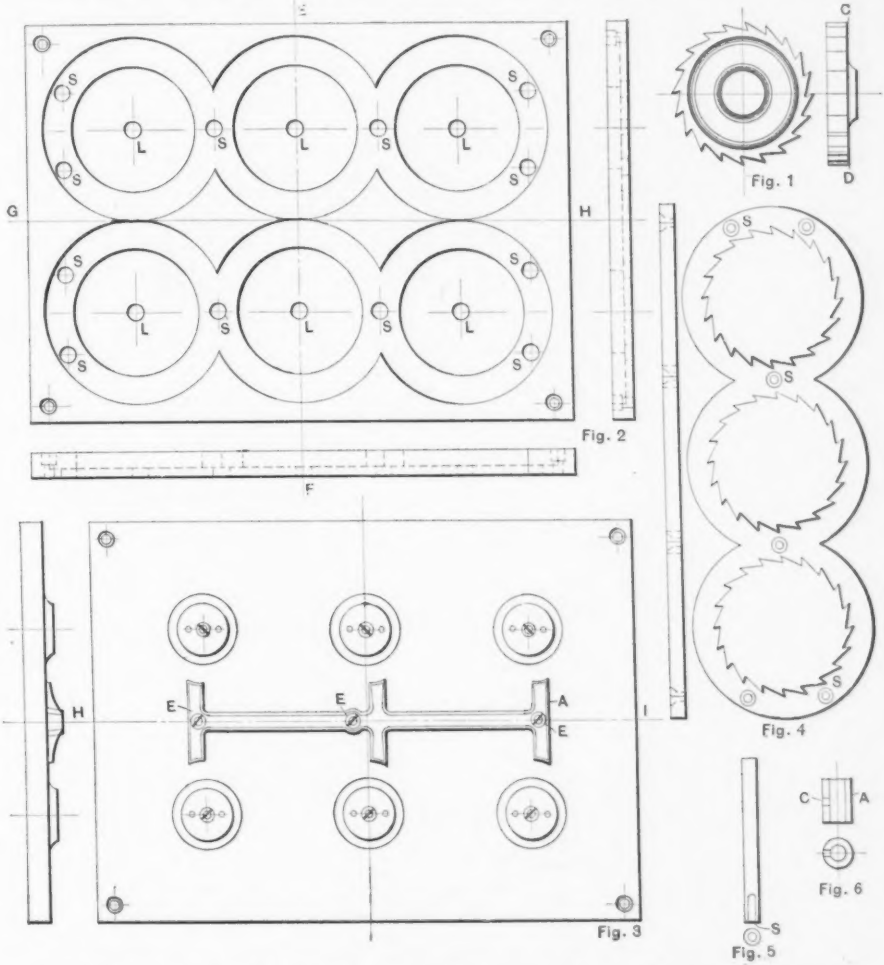


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

in Fig. 4, should next be laid in the recesses in the drag plate and the holes S marked through on to the stripping plate. Designating marks 1 and 2 should also be placed on the stripping plates, so that they can be returned to the same position in the pattern plate. Holes should now be drilled through the stripping plates corresponding to holes S as marked from the pattern plate. These holes should be countersunk for flat head machine screws, so as to bring the heads of the screws flush with the surface of the stripping plates. Next place the drag pattern plate on the molding machine and set the stool posts shown in detail, Fig. 5, in the holes S in the pattern plate. Then place the stripping plates shown in Fig. 4 in their proper places on top of the stools and mark the center of each stool so that the tap holes S in the ends of the stools can be drilled as indicated in Fig. 5. Care must be taken to see that each of these stools is of exactly the same length, and, after they have been laid off, they must be removed and drilled and tapped to receive the countersunk head screws. These stools are not secured in the machine in a permanent manner, but are held by means of small weights shown at A, Fig. 6, these weights being secured to the stools by set

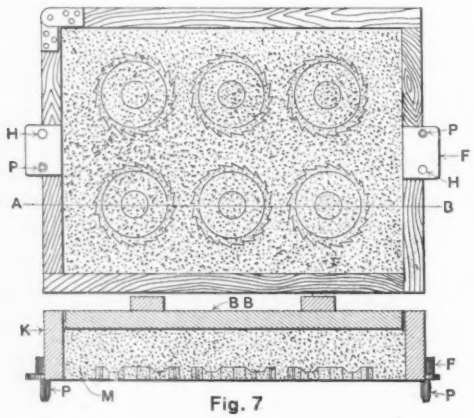


Fig. 7

screws passing through the tap holes C. The holes S in the pattern plate shown in Fig. 2 should be reamed or drilled out 1-64 larger than the stools, to allow for clearance.

Place a ½ inch pin in the center hole of each pattern and use this pin for locating each pattern in the proper position on the pattern plate, turning them on the pin until they are in the desired position. The patterns are secured to the plate by drilling, from the under side of the plate, through the plate and into the patterns, with the tap drill for the small countersunk head screws. Mark each pattern so that it can be returned to its proper position. Remove them, tap the holes in the patterns, and run a body drill through each hole in the pattern plate, also countersink the under side of the pattern plate to receive the screw heads. Now the parts should be assembled, the strippers being in place, the patterns being on top of them and secured with the countersunk head screws from the under side of the pattern plate. With a sharp scriber mark the outline of each ratchet wheel on the top surface of the stripping plates, remove the patterns and

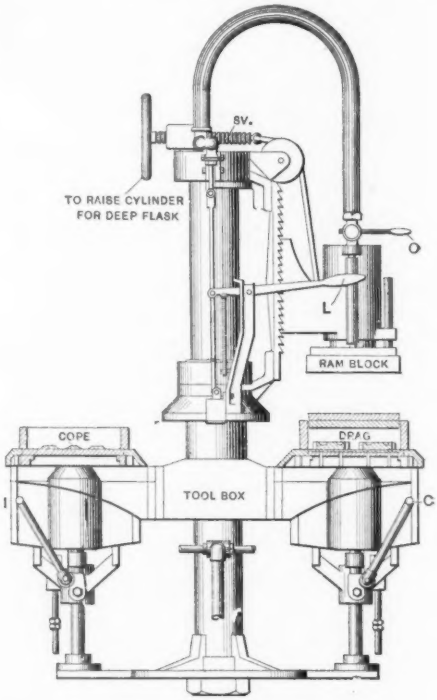


Fig.8

stripping plates from the pattern plate and the stripping plates from the stools, then clamp the strips in a vise and file them to the scribed lines. The pattern should be tried in the stripping plates while this is being done, with the use of red lead marking. This marking and trying is best done by reassembling the parts as on the pattern plate, then filing off any high spots until the strippers will work freely over the patterns. When this is completed and the parts are reassembled, the drag part will be complete. Remove the patterns from the drag plate and clamp the drag and cope plates together face to face and front to front. They

should be held in this position by means of dowel pins. Then with a half inch drill, drill the six ½ inch holes which correspond to the centers of the patterns through the cope pattern plate, using the drag plate as a jig. Drill a half inch hole in the center of each of the six patterns and place a pin in each hole and then locate them upon the cope plate, the pins entering the holes already drilled. The patterns should now be secured by screws from the under side of the cope plate, just as was done by the patterns on the drag plate. The cope plate will now be ready for the gate, which should be filed up with plenty of draft, as shown at A, Fig. 3. The gate is fastened to the plate by means of screws as shown at E, Fig. 3. This will complete both the drag and the cope plates.

The flask shown in this case is a wooden snap flask with special fittings and two round pins at each end, one in each half. In fitting up the flask the pin holes should be drilled with the aid of the flask jig, so as to make them interchangeable with the holes in the machine. In Fig. 7 the plan of the drag half of the flask, together with a section on the line A-B, are shown.

Everything is now ready for making the mold. For this we proceed as follows: The drag portion of the flask is placed on the machine, some facing sand sifted over the patterns, and the flask filled with heap sand. A block or board is then placed on the bottom as shown, and the ram block brought down by admitting air by means of the lever O. After the sand has been rammed the lever O is released, when the air will be automatically exhausted from the cylinder and the ram block be raised. The lever L is then used to unlock the ram and allow it to be swung to one side. The lever C is then used to raise the drag from the machine and to strip the mold off from the patterns. The drag is lifted off and placed on the floor. The operator then steps to the other side of the machine, sifts sand over the cope patterns, fills the cope, swings the ram block over it and rams the mold as described in the case of the drag. The sprue is then cut and the cope lifted from the pattern by means of the lever I. The cope is placed on the drag, which is already on the floor. This operation is repeated as often as required. It is also possible to make several drags first and then several copes to cover them.

CAST IRON BORINGS.

Mr. Wm. H. Derbyshire, president of the Chambersburg Engineering Co., of Chambersburg, Pa., writes as follows in answer to an inquiry from the editor as to his experience with the use of cast iron borings in the cupola:

"The writer has used for a number of years cast iron borings and turnings in the cupola, principally for heavy work. The borings are packed in rough wooden boxes one foot square and the covers nailed on. The boxes keep the borings together and prevent them from being blown out of the cupola by the blast. The wood does not burn until the charge reaches the hottest part of the furnace. There seems to be a tendency for the borings to harden and chill the mixture and we do not advise their use for light work and small heats, nor do we recommend too free use of them in each charge."

THE MEN WHO ARE RUNNING THE FOUNDRY.

In ye olden times, when knowledge was power
  And chemists fought shy of the foundry;
The foundrymen studied the grades and the blower,
  When he felt in a bit of a quand'ry.
'Tis certain he could mix materials crude
  And satisfy all—aye and sundry,
But that was before the days of "drugged ore,"
  Or the chemist came into the foundry.

New methods of mixing have come into vogue
  Since the chemist got into the foundry.
And the molder—a fool—is more of a rogue
  Now the chemists are running the foundry.
Thus:—"Analysis B. is equal to C.,
  If carbon is kept near the bound'ry."
"Try coke low in ash," and mix with a dash
  Of the flux they use down in the laundry.

We hear a great deal about figures and signs,
  Now the chemists are mixed in the foundry.
We've discovered the cure for cold-shuts and faint lines,
  —It's a chemical mix in the foundry.
When iron —Fe, contains Si, P.
  Or anything else in excess,
The chemist is sure, CC. is the cure
  Or graphite, or Mn. + S.

Combustion is said to develop C O.,
  Ere the chemists got running the foundry,
No wonder there's blowholes and castings don't flow

Where the chemists are running the foundry.
The elements come and the elements go
And the language is complex and thund'ry,
—A great deal depends on the length of the "blow"
And the man who is running the foundry.

The amorphous conditions of some molders I know,
Shows a chemical change in the foundry.
The reaction was caused by a wrong formulo,
Of the chemist who puzzled the foundry.
The cupola "hung," the "heat" it went bung,
And the iron was quite "carborundry"—
—With a little "Horse-sense" the trade could dispense
With the chemists who live on the foundry.

The molder of old took some pride in his joints,
Ere the chemists got running the foundry,
But now he's disturbed by the decimal points
That these chemists send in to *The Foundry*.
As it only remains to mix "pigs" with brains,
And study the needs of a foundry,
The molder who clings to the acid of things,
Is the best man for running the foundry.

—*Vinculum.*

BELL CRANKS AND SMALL CHILLED CASTINGS.

BY C. NEIL.

A small bell crank casting about two feet long is shown in Figs. 1 and 2. It will be noticed that there are hubs at the sides of the projecting arm which would make it impossible to draw this through the sand, and the length of the arm also makes it impossible to use pieces that would draw back into the mold. The dotted lines outside of the hub in Fig 2 show the core print for the dry sand core used for making the hub. The dotted lines inside of the hub show the form of the end of the pattern for making this arm, the core print being located upon this end, but being left loose during molding. A top view of a cast iron core box used for making this core is shown in Fig. 3. Fig. 4 shows a back view of the same, and it will be noticed that the pattern for forming the portion of the arm and the hub is so arranged that it can be drawn out through the back of the core box. A section of the core box is shown in Fig. 5 with the hub in place, while in Fig. 6 the box

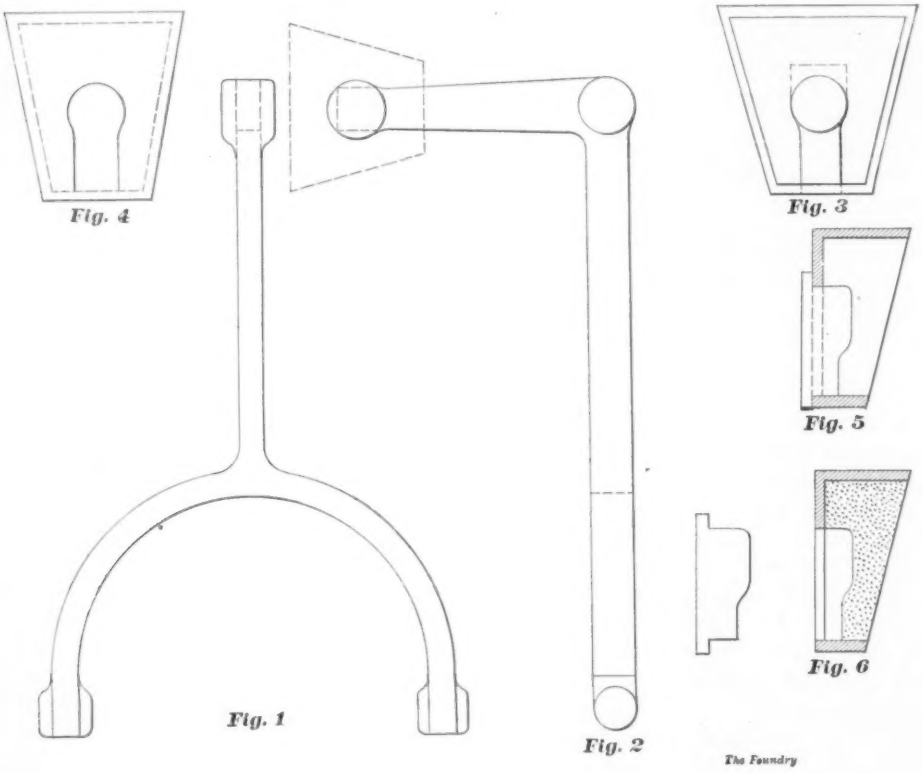


Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5

Fig. 6

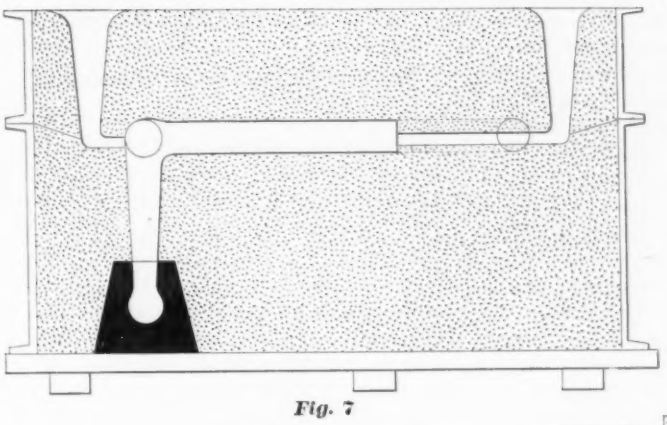


Fig. 7

Fig. 8

Fig. 13

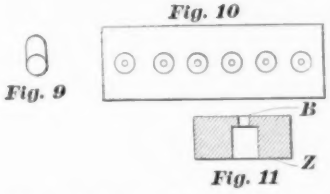


Fig. 9

Fig. 10

Fig. 11

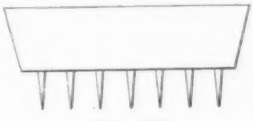


Fig. 12

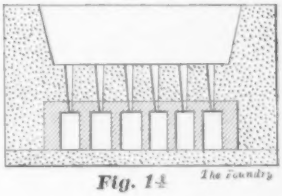


Fig. 14

is shown in section with the core in place, and the loose piece or pattern withdrawn from the back of the core box. The two halves of the core are dried separately and then pasted together. By drawing the pattern through the back of the core box perfect edges are left at the joint, which insures a perfect casting. A section of the mold closed and ready for pouring is shown in Fig. 7, the core being indicated by a solid black section.

In molding these cranks the pattern with the core print in position is placed on the face or follow board, with the nowel part of the flask around it, and rammed up. The nowel should be of such a depth that the core print will come level with the bottom board of the flask. When the nowel is rammed up and vented it is turned over the face of the mold cut down to the parting line, the cope and gate pins put in position and the cope rammed up. The cope is then removed, the pattern withdrawn and the runners cut. The nowel is next laid on its side, the core print removed, and the core put in place, the bottom board being laid against the bottom and the nowel turned down on the floor once more. After putting the cope on, the mold will be ready for pouring.

Where such flasks as this are provided with projecting handles permanently secured to the flask, considerable floor space is taken up by the handles and in order to avoid this loose or removable handles are used. Fig. 8 shows an end view of the flask, the pockets for the

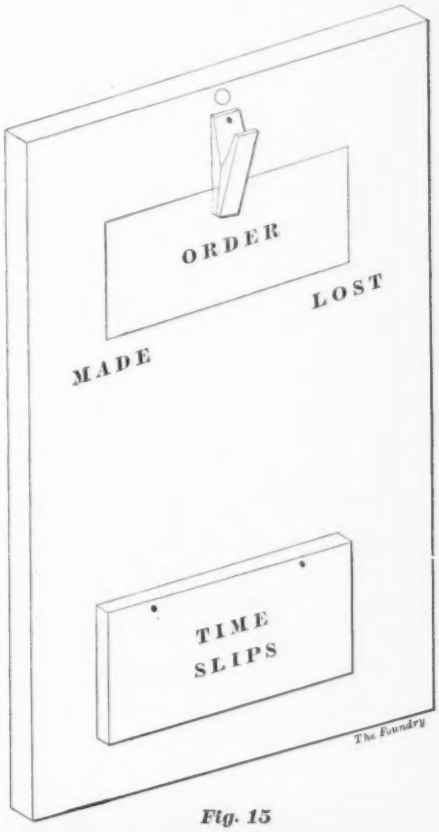


Fig. 15

removable handles being located at X, and one of these removable handles being shown at A. The handles are made of hardwood, and should fit well in the opening of the flask.

A small round chill casting used as an axle or journal for a sliding door sheave is shown in Fig. 9. These are cast in chills, a bottom view of one of which is shown in Fig. 10 and a cross section in Fig. 11. The small holes B are intended for the gate pins to enter. The gate pins and pattern for the runner are made in one piece, as shown in Figs. 12 and 13, Fig. 12 being a side view and Fig. 13 an end view. The mold ready for pouring is shown in Fig. 14. In using these chills, either a snap flask or a bed on the floor may be used. Where a level bed is used it is stuck up and the chills placed upon it, with the face Z, Fig. 11, down, and the runners with the gates on them are next placed in the holes in the chill and the mold rammed up and struck off. The gate piece with the runners is then removed, leaving the mold ready for pouring. When the castings are cold, the little pins formed in the holes B, Fig. 11, can be broken off easily.

Many molders have experienced difficulty in keeping track of their orders, time slips, etc., and the little trouble saver illustrated in Fig. 15 may be of service to such. The wooden clothes pin at the top serves to hold the order in place. Beneath this are the words "Made" and "Lost," below which the molder can keep his records in chalk, changing them from day to day. A small pocket for time slips is arranged at the bottom. By having a record of the castings made and lost always at hand, both the foreman and molder will avoid much difficulty in counting over and checking up castings.

Clarence H. Howard, who a few months ago resigned the vice presidency of the Consolidated American Steel Foundries, has acquired a controlling interest in the Commonwealth Steel Co., of St. Louis, Mo., with works at Granite City, Ill., and has been elected president. The company is capitalized at $1,000,000. It is announced that the plant will be utilized for the manufacture of railroad specialties.

The molding machine foundry of the International Steam Pump Co., Harrison, N. J., started Sept. 1 with about 75 employes. This is the first part of the plant to begin operations. The others will follow as soon as the construction can be finished and the machinery installed.

ASSOCIATIONS AND SOCIETIES.

Philadelphia Foundrymen's Association.

HOWARD EVANS, SECRETARY, CARE J. W. PAXSON CO.

The 139th meeting of the Philadelphia Foundrymen's Association, being the first one after the summer recess, was held at the Manufacturers' Club on Wednesday evening, Sept. 7th.

The paper of the evening was on "Mechanically Made Cores," by George H. Wadsworth, superintendent of the Falls Rivet & Machine Co., Cuyahoga Falls, O. Mr. Wadsworth had one of his machines set up and demonstrated the making of both cylindrical and prismatic cores. This paper will be printed in the November number of *The Foundry*.

Mr. Chas. H. Thomas, of Newark, N. J., president, and Mr. Frank C. Everitt, of the J. L. Mott Iron Works, N. Y., secretary of the Associated Foundry Foremen, were present, and explained the objects and work of that organization. A number of foundry foremen were present and steps were taken toward the formation of a Philadelphia section of the Associated Foundry Foremen. After the meeting lunch was served in the roof garden.

Cleveland Foundrymen's Association.

W. H. NICHOLLS, 608 GORDON AVENUE, DISTRICT VICE-PRESIDENT.

Cleveland Foundry Foremen.

The Cleveland Foundry Foremen held a meeting on Sept. 2. After roll call and the usual business, H. M. Lane, editor of *The Foundry*, gave a short talk on foundry education. This was followed by a general discussion upon foundry subjects, in which a large number of those present took part and some interesting matter was promised for future meetings. The Cleveland Foundry Foremen's Association is certainly in a flourishing condition, and the members are taking an extremely active interest in the mutual welfare of the club.

PITTSBURG FOUNDRYMEN'S ASSOCIATION.

F. H. Zimmers, Secretary, care Union Foundry & Machine Co.

THE ASSOCIATED FOUNDRY FOREMEN.

Frank C. Everitt. Secretary, 2413 Third Ave., New York, N. Y., care The J. L. Mott Iron Works.

ERIE FOUNDRY FOREMEN.

W. F. Grunau, Dist. Vice Pres., care Erie City Iron Works.

MILWAUKEE FOUNDRY FOREMEN.

Thomas Glasscock, Dist. Vice Pres., care Pawling & Harnischfeger Co., Milwaukee, Wis.

CHICAGO FOUNDRY FOREMEN.

David Spence, Dist. Vice Pres., 142 Bunker St.

NEW YORK FOUNDRY FOREMEN.

S. M. Williams, Dist. Vice Pres., 221 Third St., Elizabethport, N. J.

INDIANAPOLIS FOUNDRY FOREMEN.

W. H. Holmes, Dist. Vice Pres., care American Foundry Co.

REVIEWS.

MOLDING SAND FOR STEEL CASTINGS.

Stahl und Eisen, Aug. 15, goes into the differences between the molding sands and other materials used for gray iron and for steel castings. For the latter the refractory qualities must be much better, as the casting temperature is higher. Three varieties of molding sand are applicable in the steel foundry. Sand for molds which are to be baked very strongly. Green sand for steel castings, and the filling sand put back of the other varieties to complete the mold, but not to get into contact with the molten steel. The first named variety must be refractory enough to stand baking at red heat, if necessary. The sand naturally varies with the steel to be cast in it. For instance, where the walls of the casting are but ½ inch thick, and the carbon of the steel is pretty high, which means a comparatively low casting temperature, the ordinary molding sands may be made to serve the purpose, provided that a good refractory wash be applied on the face of the mold.

High grade sands must be quite free from fluxing impurities, such as soda, lime, etc. The best materials to make them from are old fire brick, old crucibles, quartz with graphite and clay as a binder. The higher the refractory qualities, the less plastic usually the material becomes, hence it is necessary to add molasses water, or else a little very refractory but plastic clay. Care must be taken not to get too much clay into the sand, otherwise the venting properties will be too much reduced. For the latter purpose ground coke, sawdust, molasses water, etc., is added, but for very heavy castings, where the molds are burned very strongly, this material should be used sparingly, as the clay contained, by reason of the heavy firing, develops hair-like shrinkage cracks, which allow the gases to escape. If coke or anthracite dust is added in too great a quantity, the baking will not have removed them completely and the steel will boil. It is better to use crushed coke for venting canals, and to put in special vents, so that in this way the molds can be baked less strongly in the first place.

While formerly the sand was pounded as strongly as possible, at the present day this is only done for very heavy parts. Where there is difficulty from excessive shrinkage strains, and where the walls are light, the sand should not be packed too strongly.

In many steel foundries, crushed crucibles are the chief part of the sand outht. In fact old crucibles, fire brick, clay, quartz, and even graphite, are all best bought in lump and crushed on the place, thus insuring rejection of the contaminations introduced when these materials are bought ready made. Quartz should be heated to redness first, then crushed, so that any organic matter found is destroyed which would otherwise cause trouble in the mold.

The mixing is done in the mill, the clay and graphite being added last. Here are several good mixtures:

For castings up to 2 inches thick—all qualities given being by measure and not by weight:

	I.	II.
Old facing sand	8	12
Old crucibles	2	..
Fire brick	2	..
Clay	2	1
Coke	1	..
Quartz sand	..	5
Graphite	..	2

For castings over 2 inches thick, similarly:

	I.	II.
Old crucibles	10	..
Fire brick	5	..
Clay	3	1
Ground coke	1	..
Old facing sand	1	..
Quartz sand	..	5

It is better to have two kinds of sand, as per above mixtures, always on hand so that heavy pieces may not be cast into light sand, and vice versa. The above mixtures are understood to be for the facing sand only, the balance of the mold being filled with common varieties.

The wash for the molds consists of the same materials—finely powdered fire clay, fire brick, crucibles, quartz and graphite.

The tempering of the sand should be such that it will ball properly, and yet not stick to the pattern. The amount used should be about

¾ to 1½ inches in thickness, applied with the hand. The common sand is then rammed in. After the sand has been pounded, and the pattern withdrawn, the mold is vented, dampened, and slicked off. Weak corners are nailed up, and where the casting is apt to tear, ribs are cut into the sand to assist in holding the metal after casting. The wash is then applied to the mold, and it goes into the drying oven.

Green sand molds are often used for steel castings, where but little finish is required, such as for mine car wheels, agricultural machine parts, bed plates and the like. The thickness of the castings does not exceed 1¼ inches or thereabouts. The acid steel process can only be used for this class of mold (we can nevertheless show a few American works where the basic process is used in green sand mold steel casting work successfully). The molding sand is a pure quartz sand mixed with a little high grade fire clay, usually mined ready for the foundry. The molds are always dusted with finely ground quartz, fire brick, or crucibles.

THE PREPARATION OF MOLDING SAND.

Giesserei-Zeitung, Aug. 15. Much more attention is paid to the preparation of uniformly fine, loose, and well binding molding sand in Germany than in this country. As a consequence German castings have a specially smooth and shining surface. Where machine molding is the rule, a rather lean molding sand is required, as but little venting and slicking is allowable, for economic reasons.

A properly prepared molding sand must allow the gases to pass through it readily and yet produce a mold which will resist the pressure of the iron, while not burning the sand. Practically every molding sand worthy of the name can, by judicious treatment, be so improved that perfect castings may be made in it. Old molding sand may be used with the new in about the following proportions: One-third to one-fifth new sand to two-thirds to four-fifths old sand. To this about 3 to 6 percent of sea coal is added. The highest percentage is for the heavier castings.

Sand must have the proper temper. As a rule the sand is made too damp. About 6 percent of water is the maximum allowable. That is, on drying a tempered molding sand at 212 degrees F. no more than 6 percent should be lost.

Mr. G. Knauth, who writes the article in question, then describes an ideal method of preparing molding sand for the modern foundry. After the molds have been dumped, and the sand quenched with water, the whole material goes into the drying pans or rotating drums, externally fired. A suitable blast hastens the operation of drying by removing the moisture as quickly as it is given off. After this the dried sand drops between rolls which have spring adjustments, and here all lumps are crushed, the shot passing through without damaging the machine. The sand now drops into a shaking sieve, the shot being caught. In the meantime the new sand has undergone a similar process, is mixed with the old sand, sea coal is added, and the whole goes through a mixing machine. The required amount of water is added in this operation. Here it will be noted whether the sand has the required temper or not, and the proper correction applied. If too wet, the sand will ball up, and bung up the machine; if too dry a simple test will quickly show it. In America we would use a centrifugal mixer, and probably add a magnetic separator somewhere in the cycle of operations.

The object of mixing the sand by machinery instead of by hand lies in the introduction of a layer of air between the individual grains of sand, making it feel as soft as wool to the touch as it leaves the apparatus. This special plasticity and softness in the sand makes it hug the pattern closely, which means a smooth casting. The upshot of this argument is that a good sand mixing machine is a valuable addition to the foundry equipment.

The advantages of a well arranged system for the preparation of molding sand may be summed up as follows: Every molding sand may be adapted for the work to be done. Molding becomes cheaper, and the molds more perfect. Little venting and patching are required as against the tempering of sand by hand. The castings get a clean and smooth surface with a good color. Cleaning the castings is easier and less expensive. The labor cost is less than hand preparation for the quantity of sand handled, and the results are much better.

ANCIENT FOUNDRY HISTORY.

Giesserei-Zeitung, No. 8 et seq. A very interesting series of articles on the history of the art of founding are appearing in this journal. It will undoubtedly be of interest to us to learn that as far back as 2000 B. C. the ancient Egyptians made bronze castings by the

cire perdue process, the mold being of loam or stoneware. In some of the old bronzes there are to be found patches which have evidently been burnt on to repair defective spots. We can also see the cross sections of bronze rods, distributed systematically, and serving as chaplets to hold the cores in position. These rods were afterwards filed down to surface on the outside.

The Etruscans went further and developed the art of casting bronze to a remarkable extent. Their cities were filled with large statues of their gods and heroes. The Romans, when sacking Volsinium, 267 B. C., took away over 2,000 bronze statues, some of which were exceedingly large and heavy. The museums of Florence, Rome, Voltera, and the British Museum in London are filled with statues dating back to Etruscan times, and their lamps and mirrors are especially beautiful. One of the statuettes in the British Museum even has diamonds set for the eyes.

The Greeks were also quite proficient in the art of casting, though they had the peculiarity of smelting the ores of copper, tin, zinc, and lead; and not the metals themselves. We therefore find iron and phosphorus in the resulting product. Pliny makes special mention of the bronzes of Delos, which were much sought after for the casting of frames for chairs and couches. He gives us some further notes on the casting of statues, in which one-third the quantity of scrap metal is added to the regular charge of ores and fuel. The so-called *plumbus argentarum* (silver-lead metal) had twelve and one-half parts of equal proportions of tin and lead added to every hundred of the regular bronze mixture. The highest grade of bronze was called *formalis temperatura.*

Turning to the Assyrians and Chaldæans we find objects cast in lead (*annak*). Bronze was quite common, the oldest statue being that of King Rim-Aku (2000 B. C.), which was discovered near Bagdad. The origin of the art of casting bronze is attributed to the primeval Turanians, living in Mesopotamia, before the advent of the Semitic races from the South, as also the Aryans from the East. The cuneiform inscriptions of the Assyrians have a word for bronze, which is not the case in the hieroglyphics of the ancient Egyptians. Iron was also well known by the Assyrians. They called it *parzil,* and used it for arms and implements. The inhabitants of Kurdistan are winning their iron at the present time in the way of the old Assyrians.

Returning to the Greeks, we find that they were in the habit of casting gold. The real monopolists in the metallurgical line were the Phœnicians, who spread the knowledge widely in their travels. The Excavations of Schliemann have shown that the Greeks were well aware of the proper composition of good bronzes, as many analyses of their material have shown. Even Greek mythology deals very extensively with the product of the foundry. All the above refers to bronzes and the individual metals going to make this up. Casting iron came at a later period.

CASTING ALUMINUM.

The Mechanical World, July 22. The matter of casting aluminum for pattern work is assuming such prominence, that a little general information on this subject will not come amiss. It is important to make the mold suited to the casting. For instance, a plain bar can be molded up as hard as may be, and if well vented, will come out perfect. On the other hand, a thin ring, unless molded up soft enough to allow the metal to compress it, will be sure to tear apart. Hence, wherever the metal is to enclose the sand, this must be left as soft as possible, to allow for compression during the cooling of the casting.

Ram the sand as little as possible, use as dry as possible, vent freely, and you are pretty safe. Aluminum is quite brittle at the critical temperature, hence the least strain at that time injures it. Cores should be soft, and coated with graphite. The sand should be new, and while no facing is necessary, a good dusting with soapstone can be recommended. The slicking tool should never be used on a mold.

Melt the aluminum in a plumbago crucible, previously rubbed up with graphite. When the metal is melted, it should be poured at once. Gates should be wide, and of a generous area. Big feeder heads are not advisable, as they do not feed, but rather draw away the metal from the casting. The metal should not be too hot, a good claret color is sufficient, when observed by putting aside the skin with a stick. Fluxes are unnecessary; occasionally, however, cryolite may be used to advantage. All sodium salts should be kept away. Zinc can be added, though the metal should not then be sold as an aluminum casting. Up to 15 percent can be used safely. Tin should also not be added to the aluminum.

METALS IN FOUNDRY PRACTICE.

Devoted to inquiries from Practical Foundrymen on subjects relating to the Melting and Using of Cast Iron, Steel, Brass and Bronze.

We are glad to announce that the Cast Iron Notes, as formerly, will be written by Mr. W. J. Keep, and also that we have secured the services of the following well-known experts to answer inquiries along their special lines:

J. B. Nau, Metallurgy of Steel and Steel Castings.

Dr. Richard Moldenke, Malleable Castings.

We have also made arrangements with several others to act as special contributors upon Brass, Bronze and other subjects. All inquiries should be addressed to the Editor of THE FOUNDRY, and they will then be forwarded to those in charge of the different subjects.

CAST IRON NOTES.

BY W. J. KEEP.

Sash Weights

Question. We operate a 15-ton Colliau cupola and melt nothing but machine scrap and stove plate. We generally run down quite a batch of sash weights at the end of the heat, using mostly stove plate. We accumulate a great deal of wrought iron, steel and malleable scrap iron; this we have been in the habit of shipping to junk dealers. Would it be practical and profitable for us to use this material in sash weights and how could we do it? We would prefer to cast the sash weights at the end of the heat?

Answer. First try using half stove plate scrap and half steel or wrought scrap. Use more coke to be sure to get the iron out hot. You will soon find how much of your steel or malleable scrap and how little cast iron you can use.

Use a little limestone or oyster shells to make the slag fluid.

Blow Holes.

Question. I am sending to you a small casting pitted with holes on the upper side. Would be very glad of your opinion as to a remedy. This casting analyzed Si. 2.82, S. .08, Mn. .52, P. .6 percent. The peculiar feature is the number of glistening particles on the walls of the holes. Large castings at times show signs of shrinkage.

Answer. There is nothing in the composition that would cause the blow holes, and the shining particles are no doubt graphite. Pour your iron at a higher temperature so that the gas can get out before the iron sets.

Vent the mold so that the gas can get out rapidly.

Cutting Through Cupola Bottom.

Question. In three successive heats of late when about one-third of the heat has been drawn off, a leak has developed near the middle of the bottom which we are not able to stop. This seems mysterious to us. Do you think that this is due to any natural cause or do you think it has been caused by carelessness.

Answer. If you have the same man that has formerly done this work I should be afraid that he purposely made a poor bottom. No outsider could injure a cupola bottom without his knowing it. The bottom doors should be firm when closed and should not spring when the cupola is full. It is best to have ½-inch holes about 6 inches apart through the bottom doors to let out moisture. Put pieces of iron over any large holes in the doors. After a run out a door is likely to be cracked when it will spring. Patch strong or get a new door. Use gangway sand or sand from the cupola dump, riddle through a ¼-inch mesh, temper and ram as for ordinary molds. Be sure that the bottom slopes 1 or 2 inches from back to the tap-hole.

If your cupola is small in tamping around the sides the feet of the man will tread the center too hard. It should be as hard and as even as an ordinary mold. If too wet or too hard the bottom will boil and raise up and crack. If kindling is thrown in carelessly sticks may be driven into the bottom. The ladder may be driven into the bottom. Don't let the first coke charged cut the bottom. When a bottom begins to cut through shut off the blast and draw out all melted iron while you direct a stream of water from a hose against the leak. By this time have ready a 2-inch plank with a ball of clay on the end as large as your head. Arrange a fulcrum so that the clay can be brought up against the leak. Tamp the clay all around and fix the plank to stay. If the leak is stopped run off the heat keeping the bottom cool with water. If it is not stopped drop the bottom. It will not pay to make another trial.

(NOTE.—The above was sent by mail and a reply stated that they had found the cause. It had been their custom to leave the tap-hole open until the iron came down and afterward to let the slag blow out of the tap-hole with the iron. They found that the sand bottom became so dry that just back of the tap-hole the sand was all blown out of the tap-hole letting the melted iron reach the bottom door. As soon as a small tap-hole was used there was no more trouble.)

BRASS FOUNDRY NOTES.

Query. What is the composition of a good alloy for making pattern letters? Also, what is the best form of molds or chills for casting the letters, and of what should the molds be made?

Answer. Use an alloy of lead and tin, as such an alloy is soft and easily run. For instance (1st), 1 pound of lead to 2 pounds of tin; (2d), 2 pounds of lead to 1 pound of tin; (3d), 8 pounds of lead, 3 pounds of tin, and 4 ounces of antimony. The alloy can be cheapened by increasing the lead and decreasing the tin. The molds may be made of sand or metal. The metal mold is to be preferred, as it produces finer castings. Bronze is the metal most suitable for such molds.

C. VICKERS.

Smooth Brass Castings.

BY CHARLES VICKERS.

In the August *Foundry* I notice an inquiry in regard to making brass castings with "a good, clean skin." The answer by W. J. Keep recommends a facing sand, also the employment of charcoal and lycopodium as a facing.

As I understand this query your correspondent merely wishes to know how to make brass castings as smooth as other people are making them, and if he has got to compete in smoothness he has got to compete in price, and the use of charcoal-lycopodium and special "facings" will not assist him to do this—neither will it make his castings smooth.

The first thing to be looked to is the sand, if it is a good open grade of fine brass sand it needs no rolling in a mill, neither should it be used too new, but is best when burnt to a brownish black, and should be kept at such a stage by the addition of new sand as required.

Given such a sand pile properly "tempered," a clean running metal and a molder who knows how to handle both, the casting will come as smooth as the other fellow's, and will cost no more. For the metal is as important as the sand, and it does not pay to use scrap on small fine castings. New metals can be made for less than the cost of scrap, and there is no comparison in the appearance of the castings.

When brass castings come out rough it is the fault of either the sand, the metal, or the molder, or all three combined.

When a molder is unused to fine, light brass work, he is apt to gate his castings too heavy, or pour his metal too hot, either of which mistakes will cause rough castings.

Now a word about the use of lycopodium. I have noticed that the impression prevails with some writers on founding that this substance is used like flour to be dusted on the mold and then blown off again. Lycopodium is not a facing, it is a parting medium, and is one of the most expensive things used by the brass molder (present price 85 cents per pound), consequently one does not get enough of it to "dust" on anywhere. It is used merely to obtain a clean separation of the pattern from the mold, and is usually kept by the molder in a small, fine bag which contains about 3 tablespoonfuls. It is never dusted on the top of flour and would produce no result if it were. It occupies the position of a facing between the mold and metal only when a mold is printed back, and in this case it must be used liberally to prevent the very damp printed surface sticking to the pattern.

For extra fine castings, "printing back" is necessary. Briefly this is as follows: Make a printing sand by burning red a handful of new sand, put in a fine bag, add one-third plaster of paris. Make the mold, remove patterns, spray on molasses water (on the mold), then dust the impression thickly with the printing sand, then lycopodium, replace patterns, reclose mold, ram with butt rammer, finish mold, carefully skin-dry, using neither flour nor charcoal, and if the result is not satisfactory these instructions are not understood.

Brass Castings with a Clean Skin.

BY C. A. D.

Mr. Keep's answer in Cast Iron Notes, August issue, to the question—"How can I make brass castings with a good clean skin?"—is somewhat misleading. In the first place, does the questioner mean brass (copper and zinc) or bronze (copper and tin)? And are the castings light or heavy? If the castings are light and brass is the metal wanted, use 6 lb. copper and 3 lb. zinc, or clean sheet brass scrap, which will answer just as well. Do not ram your molds hard, work your sand as dry as possible, and flour the molds by shaking flour through a fine bag. Then blow it off and pour the metal fast at the lowest temperature. It is well to draw a heavy vent from the top of the castings on either side of the runner, or from the runner itself.

Good results can also be obtained by adding a small amount of aluminum to the brass, but do not flour the molds. Lycopodium is not a

facing, but a good parting material, and should be used for that purpose only. It is unnecessary to mix any kind of facing sand for ordinary work, unless you intend to skin-dry the molds.

For heavy work use a brass containing more copper. I never heard of the method Mr. Keep describes, —"sift lycopodium, then blow it off." I am inclined to think lycopodium would wash before the metal. Mr. Keep says, "Never print back patterns." I always do, or rather I print mold back on the patterns when sharp ornamental castings are wanted, using fine charcoal facing. Of course, this applies to skin-dried work only.

Phosphor Tin.

BY DAVID ROGERS.

The method for making phosphor tin which I use may not be applicable in a brass foundry doing a large business, but it is worth knowing. This method must not be confounded with the fireworks producing method of using yellow phosphorus, with or without a coating of copper sulphate. I use red phosphorus, which can be obtained in the form of powder. It will not ignite below a temperature of 240 degrees Centigrade. The melting point of tin is about 230 degrees Centigrade, or ten degrees less than the ignition point of red phosphorus, and it is this difference of ten degrees which makes the method possible.

For every 28 pounds of tin, take 4 ounces of phosphorus and ram fairly hard into the bottom of a crucible of sufficient size to receive the required quantity of tin. The phosphorus should be covered with powdered charcoal and the crucible warmed before puting the phosphorus in. Melt the tin in another crucible, bearing in mind the fact that it must be just melted and not overheated, on account of the fact that there is only a ten degree leeway between the melting point of the tin and the ignition point of the phosphorus. Pour the tin into the crucible containing the phosphorus, and after stirring and allowing same time for mixing, place the crucible in the furnace and burn off the excess of phosphorus. Arsenic tin can be made in the same way.

Cracking of Grate Bars.

BY O. B. CECIL.

In answer to your inquiry in the September number as to the breaking of grate bars, I should like to give the following explanation. After casting, the bars are left in the sand to cool, or the sand is left clogged between the ribs. This leaves the air excluded from between the two or three center ribs. The outside ribs are cold when the center ribs are still hot, and consequently, as the center ribs cool they contract and draw loose, or crack away at the ends, which is naturally the weakest part. The remedy for this is to put a few shovels full of coal dust in the sand heap, before making the molds. As soon as the castings are cool enough they should be raised from the sand and given a few raps with a hammer to shake out the sand between the bars. If treated in this way they will never crack. The coal dust is simply to make the sand fall out more freely. Grate bars of this class should never be made with more than two ribs when a more complicated form can be avoided. With two ribs they can be made from any kind of gray iron scrap without any breaking. I make many tons of these grate bars every month and never lose any from breakage. I have all of my patterns made with two ribs.

Another advantage of this construction is that they are light and easy to handle. It is also quite an advantage to me in my present location (Louisiana) to be able to use any kind of gray iron scrap for this work.

Another method of making grate bars with four or five ribs where pig iron is cheap, is to use a No. 1 soft foundry pig, having approximately the following analysis:

Graphitic carbon, 3.5; combined carbon, .15; silicon, 3.00; manganese, .32; phosphorus, .65; sulphur, .12.

This will be found to be a nice soft iron, and the center ribs will not crack away in cooling, even when left in the sand.

PERSONALS.

Mr. Jas. A. Murphy has accepted a position in charge of the foundry of the Franklin Air Compressor Works, at Franklin, Pa. This is a branch of the Chicago Pneumatic Tool Co., of Chicago, and the foundry at Franklin is very well equipped. We feel that Mr. Murphy is fortunate in securing such a good position, and the company very fortunate in securing such a good man to take charge of their foundry.

Wm. Cullen, son of President J. K. Cullen, of the Niles Tool Works, Hamilton, O., has purchased an interest in the Columbia Foundry Co., New Richmond, O., which city he will hereafter make his home.

Martin F. Murphy, formerly business agent of the Iron Molders' Union in Buffalo, and president of the New York Federation of Labor, who is well known among laboring men, has accepted the position of general superintendent of the Hewitt Mfg. Co., of Chicago, Ill. This company makes a specialty of journal bearings, especially for cars and locomotives. Mr. Murphy carries with him the good wishes of his many friends for his success in his new position.

DEATH OF D. J. MATLACK.

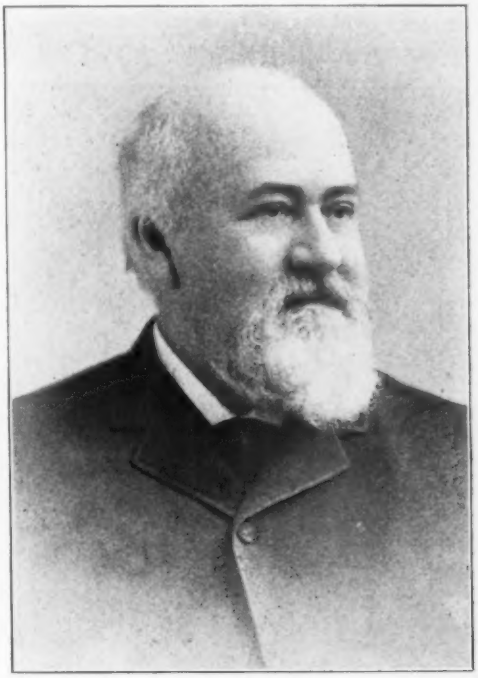
In last month's *Foundry* we had a brief notice of the death of David J. Matlack, and we are glad to publish herewith his photograph. Mr. Matlack had a career that was remarkable in many ways. He was born in Philadelphia 72 years ago, and after a common school education, entered the I. P. Morris & Co.'s shops as an apprentice in February, 1849. After his apprenticeship he remained with the company as a journeyman. In 1863 he was made foreman, and in 1875 a member of the firm. When the I. P. Morris Co. became a part of the William Cramp & Sons Ship & Engine Building Co., Mr. Matlack was retained in his position as foundry superintendent. At the time of his death he had worked for the same concern for 55 years, which in itself is certainly a remarkable fact; but when we consider the man's work and what he has done, we see that this is a much more remarkable record.

For many years the foundry with which he was connected was noted for turning out the largest and most intricate work cast in the United States. Mr. Matlack was recognized as one of, if not the foremost, foundryman in this country, if not in the world. Many engineers in different parts of the United States and Canada have consulted him concerning difficult work which they had on hand.

When Mr. Matlack completed his fiftieth year of work for the company, Mr. E. S. Cramp, realizing the unusual character of the event, tendered him a banquet, at which a great many very noted engineers were gathered. An account of this was published in *The Foundry* for April, 1899.

Some idea of the work carried on under Mr. Matlack can be formed when we consider a statement made by Mr. E. D. Leavitt, one of those present at the banquet. Mr. Leavitt was engineer for the Calumet & Hecla Copper Co., and much of their heavy casting had been done under Mr. Matlack's direction. Mr. Leavitt stated that Mr. Matlack had made castings valued at over $5,000,000 for this company alone. Some of the others who were present at the banquet mentioned were John Fritz, Dr. Coleman Sellers, Chas. H. Cramp, Edwin S. Cramp, Admiral Melvin and Samuel E. Vauclain.

At the time of his death Mr. Matlack was apparently in perfect health, and the day he died had just superintended the pouring of a very large and difficult casting for a large turbine. He went to his suburban home as usual,



D. J. MATLACK.

but immediately after dinner died of heart disease.

Mr. Matlack was a member of the American Society of Mechanical Engineers, the American Foundrymen's Association, and was a prominent Mason. He was interested in local matters and politics to a large extent. With the death of Mr. Matlack the foundry trade has lost one of the best men in this country, and we hope that his memory and life will serve to encourage others to follow his example.

Altogether too many engineers believe that the foundry is not a place where one can make a great reputation and name, and Mr. Matlack's example should surely serve to dispel any such belief.

DEATH OF ALFRED J. MILLER.

Mr. Alfred J. Miller was born at Upper Freehold, N. J., on Feb. 15, 1846. His father was James Harvey Miller, and his mother Sarah Jamison. His early life was spent at home with his parents, and he attended church and school near the historic battle-ground of Monmouth.

At about the age of thirteen Mr. Miller went into the family of Wm. Whitehead, of Middlesex county, N. J., where he learned the first principles of the business which later became his life work. With the exception of one or two years which were spent in St. Paul, Minn., he lived with Mr. Whitehead's family, and in

ALFRED J. MILLER.

1873 he married the elder daughter, Charlotte. At that time he was employed by Messrs. Chas. & Wm. Whitehead in the foundry sand and supply business, and was engaged in building up the New England end of their business, with headquarters at Providence. In 1892 the business was formed into a corporation under the firm name of Whitehead Brothers Company, with Mr. Miller as vice president, which position he held until his death. For over forty years Mr. Miller was connected with the Whitehead companies, and in active contact with their New England trade, serving always with faithfulness and ability. At the time of his death he was the oldest member in point of years' service in that company.

On July 1, 1904, Mr. Miller left his home in Providence, with his wife and daughter, in apparent good health, for a visit with friends at Camden, Me., over the Fourth. On the morning of July 2 at 10 o'clock he was stricken with apoplexy, having had no forewarning of the malady, although he had not been in the best of health for about five years. His death occurred at three o'clock on the day he was stricken, not having regained consciousness from the first.

Mr. Miller leaves a widow, one daughter, and a son, Alfred J. Miller, who for 10 years has been connected with his father's business and now takes his place with the Whitehead Brothers Company.

DEATHS.

David E. Whiton, founder of the David E. Whiton Machine Co., of New London, Conn., and for many years one of the leading manufacturers of that city, died on Sept. 11th at the age of 79 years. He learned the patternmaking trade and worked at it for some time before going into business for himself in the town of Stafford, where he manufactured turbine water wheels. He was once elected a member of the general assembly of Connecticut from that town. In 1883 he moved to New London, where he has since resided.

Mr. J. B. Ramp, for nearly 25 years foreman and superintendent of the foundry of the Murray Iron Works, at Burlington, Ia., is dead at the age of 74. Mr. Ramp was born in New York City and was a soldier in the Civil War. He was a man who was held in the highest esteem by his employes and employers.

Wm. A. Field, founder of the Fulton Iron Works in San Francisco, died Aug. 14. He was 72 years of age.

FIRES.

The Eastwood and Mankan foundry at Sherman, Tex., was burned on Sept. 9. The loss on the building and machinery is estimated at $20,000, with $12,000 insurance.

The advantage of the installation of automatic sprinkling systems in factories was shown by the fire which occurred in the foundry plant of R. W. Whitehurst & Co., of Norfolk, Va., on Aug. 18. During the night a patrolman was passing the plant, and hearing the sound of falling water, he called the owner and en-

tered the foundry. As they entered they saw a few sparks fall, but upon reaching the second floor found that the fire was already out. The fire had extended over a considerable portion of the plant, but as fast as heat reached the sprinklers they went into operation and immediately put the fire out and finally gained such headway that they drenched the place completely and prevented any further spreading. The installation of the sprinklers cost $1,700. and it appears that they paid for themselves in the night's work which they did for the company.

The foundry of Butterworth & Lowe, of Grand Rapids, Mich., was slightly damaged by fire on Sept. 7. The fire broke out twice, but was extinguished without serious damage to the building.

The plant of the Greenslade Foundry Co., of Milwaukee, Wis., was damaged by fire to the extent of $4,000 on Sept. 2. The plant is insured for $35,000, and hence the loss is fully covered. The damage will necessitate the closing of the foundry for about a month for repairs.

The plant of the Buckeye Foundry Co., St. Paul, Minn., was burned Sept. 11, causing a loss of $3,000.

The Central Iron Works, of Syracuse, N. Y., was destroyed by fire on Sept. 14. The loss will probably amount to between $25,000 and $30,000, which is practically all covered by insurance. The plant was erected 20 years ago and up to 1902 had been occupied by the Economy Foundry. A few months ago it was purchased by the Central Iron Works, and had only been running two days when the fire occurred. The company state that they will rebuild at once.

TRADE PUBLICATIONS.

The Northern Engineering Works, of Detroit, Mich., have issued a small publication entitled Bulletin No. 17, in which they describe their electric trolley hoists for handling materials in foundries, warehouses, etc.

The Abner Doble Co., of San Francisco, Cal., have issued a new catalogue entitled Bulletin No. 5, in which they describe their tangential water wheels, and they also include a set of tables which will be found of interest to any one so situated that they can operate a plant by water power.

The International Steam Pump Co., of New York, N. Y., have issued a publication entitled "Pumping Machinery at St. Louis," in which they give an account of the various installations they have in connection with the Exposition. This is gotten up in exceedingly neat style, the front cover representing the central fountain in front of Festival Hall. They include very fine illustrations of the various exhibits which they have in different parts of the grounds.

The American Blower Co., of Detroit, Mich., have issued several very neat catalogues, including a little pocket catalogue 3½ x 4 in., describing the A, B, C fans and blowers. Also three 7 x 9 describing the A, B, C vertical engines, types B and C, the A, B, C vertical engine type F, and the A, B, C horizontal engine type I. All of these catalogues are very well illustrated and contain tables and other matter of interest to those using this class of machinery.

The Warren-Webster Co., of Camden, N. J., have issued two catalogues, one 3 x 6 in. entitled "Shutting off the Waste," in which they describe the advantages of installing condensing power plants, and one 6 x 9 in., in which they describe their oil and steam separators and state the economies which result from their use.

The C. W. Hunt Co., of New York City, N. Y., have published a small catalogue 5½ x 6 in., illustrating and describing their coal handling machinery and appliances, including pocket stops, chutes, etc. They have also published a catalogue 7 x 9 in., in which they describe their electric hoists, winches and capstans. These devices would certainly be handy in many foundries, in connection with pig and scrap breakers and in similar positions.

The Oliver Machinery Co., of Grand Rapids, Mich., have issued a very fine new catalogue, describing the machinery which they manufacture. It is a 6 x 9 standard size, and is bound in blue boards with their name and design on the front cover printed in black and red, which makes a very pleasing appearance. The interior of the catalogue, however, is the part which usually interests the man in the shop and this catalogue will be found to contain a great deal of exceedingly useful material. Some of the machines described are new and represent quite radical departures from old ideas in woodworking machinery. The catalogue includes everything that would be required for fitting up a pattern shop, flask shop, or any woodworking plant. It does not go into saw mill machinery and a lot of other material which is not of interest to ordinary

shop men. Upon looking through the catalogue one cannot help but notice the fact that many of the machines follow the present practice in iron working machinery very closely. In other words, they are of stiff, rigid construction, which insures the minimum amount of vibration and the maximum amount of work and accuracy.

NEW CONSTRUCTION.

H. D. Phelps, of Ansonia, Conn., is erecting an addition to his plant 35 x 80 ft. He is engaged in the brass founding and finishing business.

The Lumen Bearing Co., of Buffalo, N. Y., have filed with the Bureau of Building plans for the construction of a one-story brick foundry, to cost about $5,000.

The Globe Machine & Foundry Co., Philadelphia, will begin on Sept. 30, the erection of a foundry 55 x 91 ft. at Cloud and Ruan streets.

The Root & Van Dervoort Engineering Co., of Moline, Ill., have awarded the contract for their new foundry, which is to be 100 x 150 ft., to H. W. Horst, of Rock Island. The new building will cost approximately $15,000.

The Wolverine Brass Works, of Grand Rapids, Mich., have taken out a building permit for an addition to their foundry. The new buildings will be of cement construction.

The Casey & Hedges Mfg. Co., of Chattanooga, Tenn., are making extensive improvements, including the erection of a new pattern shop, the foundations for which have been completed. The shop will be 50 x 125 ft., and will be equipped with machinery of the latest design. They are also planning to enlarge their power plant.

Frederick L. Downes & Co., metal merchants, of 213 Pearl street, New York City, expect to establish a large metal foundry in Elizabeth, N. J.

A site comprising 17 acres has been purchased by the Morse Iron Works, Erie, Pa., on which will be erected an extensive plant for the manufacture of malleable and cast iron fittings, and also plumbers' brass goods and supplies. Thomas G. Morse, who was formerly superintendent of the Jarecki Mfg. Co., Erie, is president of the new company. Those associated with Mr. Morse in the formation of the company are: James M. Sherwin, Robert G. Saltman, Edward Roach, C. M. Conrad, A. W. Walker, Frederick Koehler, William Spencer and Frank Payne.

The Scott National Radiator Co., Marion, Ind., has been incorporated with a capital of $25,000. The five members of the company are: Elwood Scott, Elmer Scott, Edgar L. Hampton, Warren Gardner and Alonzo E. Cloud. The company will manufacture a heating stove invented last winter by Rev. Elwood Scott.

The Twin City Rapid Transit Co., Minneapolis, Minn., has plans practically completed for the fine new buildings which will comprise its new car shops. The company owns a site of nineteen acres, of which eight acres are to be covered with buildings. The new car house will cover 3.2 acres, and will cost between $175,000 and $200,000. A motor repair shop will be 250 x 90 ft.; a machine shop, 250 x 60 ft.; a truck, frog and blacksmith shop, 150 x 100 ft.; a foundry, 100 x 75 ft.; an iron house, 75 x 25 ft. and power plant, 100 x 100 ft.

The new foundry of the Racine Boat Mfg. Co., of Racine, Wis., is nearly completed. The building is 60 x 100 ft., with a wing 30 x 65 ft.

The foundry of the Richardson & Boynton Stove Works, of Madison, N. J., is being enlarged to make room for 24 additional molders.

The new plant of the Scott-Oliver Mfg. Co., Knoxville, Tenn., will be in operation in two weeks. This machine shop and foundry are the largest of their kind in the South.

The Livermore Iron Works, of Livermore, Ky., are erecting a new machine shop and foundry. The company is owned by S. A. Davis & Son.

The Mobile Stove & Pulley Mfg. Co., Mobile, Ala., has been incorporated with a capital of $50,000 to take over the business of W. Edgar at the Edgar Foundry & Mobile Stove Works. Mr. Edgar will be president of the new company, which will manufacture stoves, pulleys, gearing, grate bars, etc. Several new buildings are in course of erection. The new stove foundry is 90 x 120 ft. and will employ 70 men. The machine shop, 90 x 60 ft., will contain the necessary equipment for the manufacture of pulleys on a large scale, and is expected to be ready before the end of the year. Mr. Edgar has been very successful as an inventor of machinery, his most successful invention being the Edgar Patent Grate Bar now extensively used in saw mills of the Southern States.

Geo. Freitag and W. H. Shurley, of New Decatur, Ill., are planning to erect a foundry and machine shop at Guthrie, Oklahoma. They expect to spend about $5,000 in the building

and $10,000 in the equipment. The main building will be 40 x 80 ft.

The Singer Co. have awarded a contract to Jas. Stewart & Co., of Pittsburg, for the erection of some of the buildings of their new $1,000,000 plant at St. John's, Province of Quebec, Canada. Among the buildings to be constructed are a foundry 100 x 400 ft., with two wings, one 40 x 70 and one 54 x 60, one of which is to be used as a cupola room and the other as a core room, also a foundry shed 75 x 200 ft. and pattern storage house 60 x 60 ft., together with other buildings for pattern shop, machine shops, woodworking plant, etc.

GENERAL INDUSTRIAL NOTES.

The Niagara Falls Brass Works, of Niagara Falls, N. Y., has been incorporated with $20,000 capital. A temporary plant has been installed and the company will make brass, bronze and aluminum castings.

The Economy Foundry, at Syracuse, N. Y., has been sold by the International Heater Co. to the Central Iron Works, a new corporation. The selling price is said to be about $30,000. The plant has been closed for about 16 months, but is to be put into operation at once.

Edw. J. Lambert, who was foreman of the Syracuse Chilled Plow Works for 17 years, has made arrangements to open a foundry in Syracuse, N. Y., for the manufacture of gray iron castings. He expects to employ about 60 men.

The American Foundries Co. has decided to increase the capacity of the plant at Sharon, Pa., by erecting an addition to the casting house 50 ft. square. It is stated that additions to other parts of the plant will be made in the near future.

The Brammer Foundry Co., of Ironton, O., has been incorporated with a capital of $5,000. The new company takes possession of the plant of the Ironton Foundry Co., and will do a general foundry business. The incorporators are: William Brammer, Allie W. Kerr, S. P. Humphrey, E. T. Belcher, and J. C. Snyder.

The Favorite Stove & Range Co., of Piqua, O., has been incorporated with a capital of $300,000.

Frank Runser, formerly manager of the Mahoning Foundry & Machine Co., has secured interests in the Forsythe Pattern Co., of Youngstown, O., formerly held by Mr. Forsythe. Mr. Forsythe has been in poor health for several months and has purchased a farm in Maryland, where he intends to reside and devote himself to agricultural pursuits for the present.

The Wabash Foundry, of Vincennes, Ind., which was formerly owned by Clarke & Buck, has been sold to A. B. Clarke for $7,350.

The Barnard & Leas Mfg. Co., Moline, Ill., have secured a large tract of land in East Moline, upon which they expect to build a foundry at some time in the future, though they will not commence building operations immediately.

The Davies Car Wheel & Machine Co. have decided to locate their new plant at Grayslake, Ill. This town has been offering special inducements to manufacturing plants to locate with them, and the site secured by the above mentioned company seems to have special advantages, as it has direct connection with two railroads. The company is incorporated in Illinois, with head offices in Chicago, and expects to manufacture railroad specialties, the patents for which it controls.

The Eastern Foundry & Machine Co., Richland, N. J., has been incorporated with a capital stock of $200,000 to carry on the business of mechanical and electrical engineers and tool makers. The incorporators are: Frederick D. Hazelton, James Donald, Andrew Donald.

The Phillips & Buttorff Mfg. Co., of Nashville, Tenn., have recently completed an addition to their foundry, in connection with the opening of which they gave a celebration at which over 2,000 people were present. The celebration commenced at 9 in the morning, and the day was spent in dances and games of all kinds. A watermelon feast was the principal feature of the afternoon.

The Mobile Stove & Pulley Mfg. Co., of Mobile, Ala., has been incorporated to take over the rapidly growing business of Mr. W. Edgar, at the Edgar Foundry and Mobile Stove Works. The capital is $50,000.

D. E. Gill, of Albany, N. Y., and Frank L. Streeter, of North Hinsdale, N. H., have leased the Richardson foundry at Brattleboro, Vt., and expect to do a general foundry business.

The Berlin Iron & Brass Foundry Co., Berlin, N. H., is building an addition 40 x 50 ft. which will be equipped with new machinery. The first floor will be used as a machine shop and the second as a pattern shop.

Arch M. Loudon, of Abendroth Bros., Port Chester, N. Y., and N. B. Payne, of the Payne Engineering Co., Elmira, N. Y., have leased the foundry of the Payne Engineering Co., and will begin operations about Oct. 1 in iron and brass castings, as the Payne Foundry Co.

Alphabetical Index to Advertisers.

Adams Co. 16, 71
Addy, Matthew, & Co. 54
Ajax Metal Co. 62
American Air Compressor Works. 50
American Blower Co. 24
American Glutrose Co. 61
Arcade Mfg. Co. 19
Atlas Car & Mfg. Co. 53
Balkwill Pattern Works. 70
Barbour-Stockwell Co. 68
Barnard & Leas Mfg. Co. 66
Barnett, Oscar, Foundry Co. 34
Bartlett, N. S., & Co. 54
Battle Creek Interior Finish Co. 72
Blackwell, Geo. G., Sons & Co. 56
Blaisdell Machinery Co. 53
Blake, Geo. F., Mfg. Co. 51
Brass Founders' Supply Co. 32
Bristol Co. 50
Brodin, John A., Pattern Works. 50
Brown Specialty Machinery Co. 29
Bryan Vacuum Molding Machine Co. 57
Buffalo Foundry Supply Co. 7
Burdick & Son 68
Carborundum Co. 64
Case Mfg. Co. 58
Cherry Valley Iron Co. 33
Chicago Flour Co. 72
Church, S. R., Co. 73
Clark Cast Steel Cement Co. 63
Clark, D. N. 22
Clayton Air Compressor Works. 50
Cleveland Wire Spring Co. 65
Coburn Trolley Track Mfg. Co. 39
Columbus Iron & Steel Co. 54
Connersville Blower Co. ....outside back cover
Cornell, J. B. & J. M., Co. 73
Cowles Electric S. & A. Co. ....inside back cover
Crystal Fluor Spar Co. 53
Curtis & Co. Mfg. Co. 8
Dalton, Nash & Co. 54
Dana & Co. 55
DeCamp Bros. & Yule Iron, Coal & Coke Co. 54
Dempwolf, E. A., & Sons. 73
Delano, E. A., Co. 21
Diamond Clamp & Flask Co. 57
Dimmick, J. K., & Co. 54
Dings Electro Magnetic Separator Co. 49
Dixon, Joseph, Crucible Co. 42
Domhoff & Joyce Co. 54
Elm City Engineering Co. 61
Etting, Edward J. 50
Falls Rivet & Machine Co. 10
Fanner Mfg. Co. 64
Field-Evans Iron Co. 55
Fulton Foundry & Machine Co. 56
Gautier, J. H., & Co. 40, 73
Gilmour, J. 57
Gobeille Pattern Co. 70
Goodrich, F. A., & Co. 55
Gould & Eberhardt 63
Hanna Engineering Works 26
Hawley Down Draft Furnace Co. 69
Herman, Charles, & Son. 18
Herron & Bury Mfg. Co. 50
Hevl & Patterson 52
Hill & Griffith Co. 5
Hillman, J. H., & Son. 55
Hunt, C. W., Co. 60
Ingersoll-Sergeant Drill Co. 30
Keep, W. J. 67
Kendall & Flick 60
Kent Mfg. Co. 23
Kilbourne & Jacobs Mfg. Co. 53
Laidlaw-Dunn-Gordon Co. 51
Loughry, James C. 73
Manning, Maxwell & Moore. 52
Maris Bros. 58
Maurer, Henry, & Son. 73
Maywood Foundry & Machine Co. 13
McCormick, J. S., Co. 9
McCullough-Dalzell Crucible Co. 43
McKeefrey & Co. 55
McRath, T. S. 55
Metallurgical Laboratory 56
Middleditch, Benjamin 71
Midvale Mining & Mfg. Co. 54
Millett Core Oven Co. 31
Mills, C. E., Oil Co. 65
Mohr, J. J. 55
National Jeloluse Co. 73
New Era Mfg. Co. 72
Niles-Bement-Pond Co. 58
Northern Engineering Works 59, 70
Obermayer, S., Co. ....inside front cover and page 1
Oregon Foundry & Machine Co. 17
Osborn Mfg. Co. 68
Otis Steel Co. 62
Pawling & Harnischfeger 60
Paxson, J. W., Co. 2, 3, 4
Pedrick & Ayer Co. 52
Pettinos Bros. 60
Philadelphia Pneumatic Tool Co. 37
Phosphor Bronze Smelting Co. 62
Pickands, Brown & Co. 55
Pickands, Mather & Co. 55
Pilling & Crane 55
Pridmore, Henry E. 12
Rand Drill Co. 36
Republic Iron & Steel Co. 35
Ricketts & Banks. 55
Ridgway, Craig, & Son Co. 28
Roessler & Hasslacher Chemical Co. 65
Rockwell Engineering Co. 27
Rogers, Brown & Co. 56, 74
Roots, P. H. & F. M., Co. ....Colored inset
Sellers, Wm., & Co. 38
Shepard, Chas. G. 56
Shuster, F. B., Co. 67
Smith, J. D., Foundry Supply Co. 6
Smooth-On Mfg. Co. 20
Souther, Henry, Engineering Co. 54
Sterling Oil Co. 73
Stevens, F. B. 47, 56
Stow Mfg. Co. 63
Sturtevant, B. F., Co. 25
Superior Charcoal Iron Co. 56
Sutch & Potter 61
Tabor Mfg. Co. 14
Taylor, Robert J., Inc. 41
Taylor, Wilson & Co. 15
Thomas Furnace Co. 56
Tilghman-Brooksbank Sand Blast Co. 61
Townsend, David 54
Vulcan Facing Co. 11
Walter-Wallingford & Co. 56
Whiting Foundry Equipment Co. 44
Williamsport Chemical Co. 49
Yale & Towne Mfg. Co. 60

CONTENTS.

Points of Interest for Foundrymen at the Louisiana Purchase Exposition. 53
Cost of Melting in an Oil Furnace. 58
Williamsburg Bridge Tablets. 59
Trade Outlook 62
Foundry Exhibits at St. Louis. 62
Use of Manganese in the Cupola or the Ladle. .. 63
An Electric Hoist for Foundry Use. 64
Cupola Fan Practice. 66
Fan Blowers for Cupola Work. 72
Some Casting Puzzles. 75
Casting Brass Liners of Propeller Shafting. 77
Cupola Practice 77
A Chain Hoist Exhibit. 79
Percentage Method of Determining Production Costs 80
Notes on the Core Room. 81
Molding Machine Practice. 82
The Men Who Are Running the Foundry. 85
Bell Cranks and Small Chilled Castings. 86
Associations and Societies. 88
Reviews 89
Metals in Foundry Practice. 92
Personals 94
Death of D. J. Matlack. 95
Death of Alfred J. Miller. 96
Fires 96
Trade Publications 97
New Construction 98
General Industrial Notes. 98-a

F.B. STEVENS

Foundry Supplies

COR. LARNED and THIRD STREETS

DETROIT

Undisplayed Advertisements.

Rate thirty cents per line each insertion. Answers addressed to our care will be forwarded.

FACINGS.—THE BERG MINING CO. always sells uniform grades; prices always lowest.

FOR SALE.—Cupola, 38-inch, rattlers and blower, for small foundry. THE J. H. DAY CO., CINCINNATI, O.

PLUMBAGO, German, East Indian, Ceylon. Highest grades, lowest prices. BERG MINING CO., NEW YORK.

FOR SALE.—One 10-ton double-geared wood frame jib crane. Address THE C. A. LAWTON CO., DE PERE, WIS.

GRAPHITE, German and Ceylon. Standards of comparison, lowest prices. BERG MINING CO., NEW YORK.

NO. 404 SILICA MOLD WASH makes the cleanest steel castings in America. J. W. PAXSON CO., PHILADELPHIA, PA.

FOR SALE.—Second-hand Baker Positive pressure blowers, Nos. 7½, 6, 5, 4½ and 3. J. W. PAXSON CO., PHILADELPHIA, PA.

WANTED.—Second-hand pulley molding machine, with patterns; for pulleys up to 36 inches. Box L, Station B, CINCINNATI, O.

FOR SALE.—Write for price on the only foundry, machine shop and boiler shop in Black Hills. J. C. O'DONNELL, DEADWOOD, S. D.

The Best Sea Coal and Bitumen Facing and at competing prices are made by J. W. PAXSON CO., Facing Millers, PHILADELPHIA, PA.

WANTED.—Salesman with experience in selling acid open-hearth steel castings. Address Box 339, THE FOUNDRY, CLEVELAND, OHIO.

MOLDERS' TOOLS.—At 25% less than usual prices, because of large stock on hand; a bargain. J. W. PAXSON CO., PHILADELPHIA, PA.

PRACTICAL FOUNDRY FOREMAN wishes to make a change. Up to date on light work and machine molding. Address Box 341, THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Foundry of two or three tons capacity by practical foundryman. Price must be low for cash purchaser. Address H. B. DAVISON, 76 Buckingham St., SPRINGFIELD, MASS.

BLACKLEAD, German. The best on earth, lowest prices. BERG MINING CO., NEW YORK.

WANTED.—Position as superintendent of stove foundry. Successful experience; open for engagement beginning Jan. 1, 1905. Address Box 337, THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Sober, industrious, non-union machinery moulder wishing good job to answer. Give experience, references, age, etc. Address "F," Box 338, THE FOUNDRY, CLEVELAND, OHIO.

FLUOR SPAR.—Every grade. Quotations delivered anywhere. Cheapest suppliers. Address Geo. G. BLACKWELL SONS & CO., Ltd., Liverpool, Eng., or agents Penna. Salt Mfg. Co., Pittsburg, Pa.

WANTED.—A salesman to sell foundry facings and supplies in Ohio. State experience, age and salary. Character reference required. Address A. B. C., Box 344, THE FOUNDRY, CLEVELAND, OHIO.

FOUNDRY FOREMAN wishes position in light or medium shop. A hustler and thorough foundryman; good handler of help and machines. Best of references. Address Box 343, THE FOUNDRY, CLEVELAND, OHIO.

BERG MINING CO., 123 Front St., New York. Prices lowest, goods best, qualities uniform.

A YOUNG MAN, with varied experience in a number of up-to-date foundries, would like to invest and take active part in a growing business. Address Box 200, THE FOUNDRY, 1164 Monadnock Bldg., CHICAGO, ILL.

WANTED.—A foreman to take full charge of a small jobbing foundry. No heavy work; capacity 3 to 5 tons per day. We prefer party who can invest small sum. Must come well recommended. Box 23, BRADLEY, ILL.

FLUOR SPAR.—We furnish best grades on the market. Ground lump or gravel. No order too small for our attention nor too large for our capacity. Prices on request. KENTUCKY FLUOR SPAR CO., MARION, KY.

WANTED.—A first-class, thoroughly experienced Malleable and gray iron foundry foreman for 100 molders. Successful business. Open shop. Large western city. Address Box 340, THE FOUNDRY, CLEVELAND, OHIO.

SITUATION WANTED.—Foundry chemist. Several years' experience in iron and brass foundry analyses. Thoroughly understands cupola management. Best references. Address Box 345, THE FOUNDRY, CLEVELAND, OHIO.

SILVER LEAD, East Indian and Ceylon. Best quality, lowest prices. BERG MINING CO., NEW YORK.

FOR SALE.—One No. 24 Paxson Colliau Cupola, 35 ft. high, legs 4 ft., spout 3 ft., doors 10 ft. (from floor). Lining for same. Above never used. One No. 3 second-hand Baker Blower in good condition. OIL WELL SUPPLY CO., OIL CITY, PA.

BLOWER BARGAINS.

Roots Second-hand Blowers, bought, sold or exchanged for new ones. Address,

H. M. PAPWORTH,
120-122 Liberty street, New York City.

PRACTICAL SUPERINTENDENT, at present associated with one of the leading stove and range companies, solicits correspondence with a view to changing. References exchanged. Address "PRACTICAL," Box 324, care THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Man, near New York, who has had experience repairing gray iron castings. One who can quickly and neatly patch castings which come from the foundry with small defects. State age, reference and wages expected. Address A. B. C., Box 342, THE FOUNDRY, CLEVELAND, OHIO.

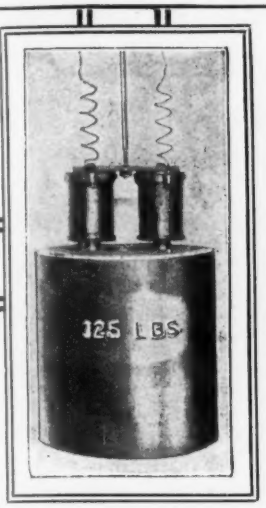
WANTED.—In Massachusetts, a foundry foreman for fine grade light and medium machine castings; must have thorough knowledge of machine molding and fitting for same; also have good executive ability. State experience, age and salary. Address "S." Box 323, care THE FOUNDRY, CLEVELAND, OHIO.

WANTED.—Situation as superintendent or general foreman of foundry by a young man with fifteen years' experience in dry and green sand and a practical car wheel man; temperate habits and married. Will invest $5,000 to $10,000 if the opening is satisfactory. Address Box 335, THE FOUNDRY, CLEVELAND, OHIO.

FOR SALE.—Foundry and machine shop; good line of patterns for jobbing work, also patterns and equipment for building the most successful up-to-date gas and gasoline engine on the market; town of 6,000; two railroads; two navigable rivers; no other foundry within 25 miles; stock, tools and real estate invoice about $7,000; a great bargain. H. H. MASON, MT. CARMEL, ILL.

WANTED.—Superintendent or general foreman for our molding departments, one who has had thorough experience with molding machines, stove plate and water heater molders; also practical cupola man, and one with good executive ability. State experience, salary expected and references. No applications considered except from an A No. 1 foundryman with practical experience. Address "A," Box 336, THE FOUNDRY, CLEVELAND, OHIO.

FOUNDRY FOREMAN.—A man of middle age to go to the South to take charge of an iron foundry using almost exclusively molding machines; experience with molding machines essential. Must be a good leader of men and of good habits; must have ability as a molder and some knowledge of mixtures and their results. Apply by letter to the undersigned with references and state wages expected. THE TABOR MNFG. CO., 18th and Hamilton Sts., PHILADELPHIA, PA.



An Attractive Proposition

We will ship on approval, to any reliable foundry having good commercial rating and melting five tons or more of iron per day, one of our money-making iron-saving magnetic separators.

A prominent official of the American Foundrymen's Association, recognized as one of the best posted men in the United States on foundry matters, has said, "The Electro-Magnetic Separator is a money maker in any foundry. In all cases coming under my observation, they have paid for themselves in three months."

In buying a separator it pays to get the best. If you do not already know that the

Dings Electro-Magnetic Separators

lead all others in points of excellency, write to us and learn the truth.

We have been building Magnetic Separators for a long time. It is our exclusive business. Perfection in this one particular kind of machinery has been our aim, and everybody knows that we have hit the mark.

We build Separators for Iron Foundries, Brass Foundries, or for any special requirements. If you are interested write to us.

DINGS ELECTRO-MAGNETIC SEPARATOR CO.
Milwaukee, Wis.

CROIL

still holds good as the best core compound for all purposes. If you don't think it's cheaper, write us.

CHARCOAL FACING

Chemically pure and made from hard wood only. We grind in any size wanted. Send for samples.

FOR SALE BY
Foundry Supply Houses

MANUFACTURED BY
WILLIAMSPORT CHEMICAL CO. Williamsport, Pa.
MANUFACTURING CHEMISTS

The new and enlarged edition of

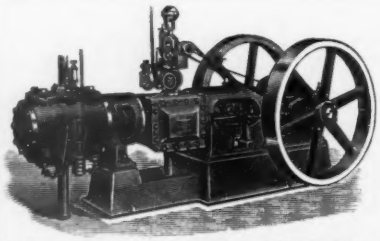
"Methods of Chemical Analysis and Foundry Chemistry"

By Frank L. Crobaugh

In these days of close competition, no foundryman can hope to succeed without a practical knowledge of foundry chemistry as applied to the everyday problems that are constantly arising. . This book contains just the clear, accurate, concise information that gets results.

Sent postpaid for $2.00

The Foundry **Cleveland, O.**



Steam Driven—Class "B S"

Air Compressors

STEAM AND BELT DRIVEN

Also arranged for direct connection to Motor

For Foundry and Machine Shop

SEND FOR CATALOGUE

HERRON & BURY MFG. CO., Erie, Pa., U.S.A.

NEW YORK: 120 Liberty Street
LONDON: J. W. Jackman & Co.
PHILADELPHIA: Drexel Building
PARIS: Fenwick Freres & Co.

I MAKE a specialty of fitting molding machines with wooden patterns and wooden stripping boards.

John A. Brodin Pattern Works

WESTERN AVE. & W. 16th ST., CHICAGO, ILL.

Estimates furnished on application. Telephone Loomis 1251

AIR COMPRESSORS

Pneumatic Chipping Hammers, Hoists, Casting Cleaners, Sand Blast Machines, Molding Machines and other appliances in foundry work. Send for catalogue.

American Air-Compressor Works, 26 Cortlandt St. NEW YORK

AIR COMPRESSORS

Send for Bulletin C201F

CLAYTON AIR COMPRESSOR WORKS, *114 Liberty St., New York City*

89

Bristol's Recording Thermometers

for CORE OVENS will pay for themselves. Send for catalogue

The Bristol Co.
Waterbury, Conn.

EDWARD J. ETTING

Foundry, Machine and Railroad Shop Equipment, Foundry Facings and Supplies

Cranes, Electric and Hand Power, Cupolas, Air Hoists, Ladles, Tumblers, Trucks, Turntables, Elevators, Molding Machines, Magnetic Separators, Pneumatic Screen Shakers, Compression Riveters, Chain Hoists, Cupola Blocks, and Brick.

Harrison Building, - PHILADELPHIA.